THE IRON TRADE REVIEW

Vol. LVII Cleveland, December 23, 1915 *No. 26*

Many Mills Are Unwilling to Sell

And Blast Furnace Operators Are Also Slow to Take on Additional Tonnages—Numerous Price Advances

WITH prices continuing to advance on pig iron and finished materials, consumers are still clamoring to place additional orders and the announcement that there is nothing to sell is being made by more mills and furnaces.

Pig Iron

The congestion on the railroads between Pittsburgh and tidewater is becoming a serious factor in the pig iron market and threatens to be much worse unless the railroads succeed in adopting some radical measures of relief. The pig iron market throughout the country is very strong and prices are steadily being moved upward. Along the lakes, from Chicago to Buffalo, quotations are higher and available iron is being rapidly reduced. The Norfolk & Western railroad is distributing orders on an inquiry for 10,000 tons of various grades for last half delivery, but not many sales for delivery after July 1 are reported. Furnaces, especially those along the lakes and in the valleys, are unwilling to quote for deliveries so far in advance.

Billets

Scarcity of billets and sheet bars continues and many consumers are worrying as to where and at what price they will be able to buy for early requirements. In eastern Pennsylvania forging billets are selling at $55 and open hearth and rolling billets at $40. Very high prices prevail in Pittsburgh.

Bars

Inquiries, amounting to several hundred thousand tons of steel bars, largely rounds for the manufacture of high explosive shells, are pending. It is estimated that the entente governments will require at least 500,000 tons of various forms of steel, principally bars, for shipment before July 1, and fully as great a tonnage for the last half of the year. It is difficult to obtain delivery on any tonnages of large size for first half on account of the mills being overwhelmed with orders. Shipments of sheet steel to Europe at present are estimated at 10,000 to 15,000 tons weekly and much of this is for shrapnel.

Machinery

The recent order of the English government in regard to the importing of machine tools into the United Kingdom does not promise to interfere with the movement of machinery to England, except that speculators who have obtained exorbitant prices will not be allowed to continue to do so. Heavy buying by Russia continues to be a leading feature of the machinery market. The freight congestion is causing considerable annoyance to manufacturers.

Sheets

Extraordinary demand for blue annealed sheets has brought about a decided scarcity and leading makers are entirely out of the market, while others are quoting very high prices. Owing to the high quotations on spelter, galvanizing operations at many sheet plants have been abandoned. Prices of black sheets have been advanced.

Wire

Prices of wire products, with the exception of galvanized wire nails have been advanced $2 a ton to a basis of $2.10 a keg for wire nails, the highest price since 1901. Wire products are now quoted at from $12 to $13 a ton above prices of a year ago, but sales at the new quotation are limited, as nearly all consumers are under contract. Advances have been made in cast iron pipe and higher prices on steel pipe are expected.

Coke

Coke is gradually growing stronger, thus eliminating the only weak feature of the present market. Sharp advances are noted in scrap in several centers and the demand is active throughout the country. The very high price of old material has caused some manufacturers of bar iron to withdraw temporarily from the market, as they have taken all the orders for iron that they desire and are awaiting developments in the scrap market. This is true in the Cleveland district.

THE OPEN HEARTH

The Flag and the Merchant Marine

THE American flag will not disappear from the Pacific ocean, if loyal Americans can prevent it. Announcement has been made by Charles A. Stone, president of the recently organized $50,000,000 American International Corporation, of the purchase of the entire remaining fleet of the Pacific Mail Steamship Co., consisting of seven steamers, which will be operated to Central American ports on the western coast. It will be recalled that the Pacific Mail Steamship Co., sometime ago, sold four of its ships to a Chinese company, owing to the hardships imposed by the LaFollette seaman's law. Speaking of the recent purchase, President Stone said, "By this step the last fleet of vessels under the United States flag on the Pacific ocean has been prevented from being broken up. The breaking up of the fleet would have taken from the Central American ports on the west coast all shipping accommodations and would practically have shut off all our trade relations between Pacific ports and that part of Central America".

This act in preventing the further humiliation of the American nation is one of patriotism and the new company which promises to do much in extending American commerce deserves unstinted praise for this first important step. Naturally, it hopes to operate the vessels at a profit and we trust that this will be true. Probably it can do so while the war is in progress and ocean rates are so high. Later, if the plans of the present administration are carried out, it will be necessary to compete with government owned boats. While the competition would be serious, it does not mean that the government boats would be operated at less cost than those privately owned, any more than it is true that the government builds boats at lower costs than private yards. Some of the methods adopted by the government to make a showing in building ships were disclosed in these columns in the issue of Dec. 9. Now comes Secretary Redfield in his annual report and indulges in some very pertinent remarks in regard to false ideas of economy. He says that in his report illustrations are not wanting of the costliness of what is sometimes called economy. Then he asks these questions:

Was it economical to have the ALBATROSS lie at the dock month after month with her crew under full pay for lack of an appropriation sufficient to buy supplies and coal? Was it economical to keep in service such wrecks as the MCARTHUR and the GEDNEY, only to replace them when prices are high and when vessels must be hired while the new ones are building lest the work needed for saving human life should stop? Is there economy in stopping the reinspections of the steamboat inspection service in the busiest month of the year and in giving instructions to supervising inspectors to go about their districts as little as possible because there is not money enough for traveling expenses?

The secretary remarks that the conditions which suggest the questions are the results neither of economy nor of accurate knowledge of the work required. He might have added that just these conditions or worse would prevail if the government should obtain control of the merchant marine and operate it.

This country needs a merchant marine and needs it badly, but not one operated according to the wasteful methods of the government.

Legalizing Boycotts and Blacklists

THE positively dangerous character of some of the plans proposed by the United States commission on industrial relations and now being advocated by the committee appointed for that purpose, apparently dominated by Chairman Walsh, becomes apparent as these propositions are given careful consideration.

The commissioners committed themselves positively in favor of collective bargaining, and there was nothing very startling about that position, but the next proposition is to relieve all organizations of employers and employes from liability to be brought into court in civil actions on account of unlawful acts. All civil suits having been made impossible, criminal proceedings alone would remain. Even damages inflicted in the committing of crimes, such as assault and arson, would not be recoverable unless conspiracy could be proved and often that is extremely difficult. Sympathetic strikes, secondary boycotts, blacklisting and unfair methods of competition now forbidden by law would be legalized. In a review of some phases of the report of the commission, Walter Gordon Merritt, associate counsel of the American Anti-Boycott Association, says:

"Societies like the American Federation of Labor with its millions of supporters throughout the country, and associations of employers like the National Association of Manufacturers exercise a power for good or ill entirely beyond the reach of the individual and beyond all precedent in the world's history. Will it decrease their tendency to oppress or overreach, will it teach them self-restraint and responsibility to society, if we do not exact from them even that measure of discipline which controls the unorganized individual? Should we not, on the contrary, impose larger obligations on them for the privileges of organization which they enjoy and the dangers they

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entail, and let them answer to the law in a larger measure than ever before for the harm or disturbance which their propaganda and activities create?"

Clearly the taking away of liability for the results of unlawful acts on the part of labor unions, which is in itself a wrong, is not made right by committing the further wrong of relieving manufacturers from the results of unlawful acts. All sorts of organizations, whether of employers or employes, ought to be held to the strictest accountability and any step like that proposed by the members of the late commission ought to be vigorously opposed.

Economic Preparedness

THE country is enjoying a remarkable era of prosperity and all indications are that the great volume of present business will be continued for a considerable time. To a large extent, the influx of wealth into this country is directly traceable to the unprecedented demand from abroad for iron and steel products, but a careful analysis of conditions shows that strictly home business is steadily expanding. Some industries whose products are in no way affected by the demand of warring foreign nations are increasing rapidly. We are indeed prosperous.

It may be recalled that Great Britain was prosperous. She was rich, and to those who object to the past tense of the above, we may say, *is* rich. But—has not her wealth been impaired, in a measure? Has not her credit been a subject of serious consideration? It was necessary to secure a recent loan with collateral of unimpeachable worth. And why?

Because she was in a state of war. War, that leveler of all things human, attacks its victim in the most vunerable spot, the pocket book. Hence, the foresight of nations has been directed along lines that tended to reduce to a minimum the risk of becoming impoverished.

And the lesson? Preparedness, not FOR war, but AGAINST it. This United States of America is far too rich a prize not to be envied. What, then, is the real value of preparedness, if not to guard our treasures and guard them well? A war of conquest has never been waged by the United States, moreover it is more than likely that it never will be so waged, but have we assurance that such a war will never be taken up against us?

If we neglect the sanctity of national peace by neglecting the power to enforce our rights, we must pay the price. And that price, a war indemnity that would be demanded and collected, would stagger us with its immensity.

Yet there are some people who are so dense as to insist that the armor plate manufacturers are seeking only to further their own ends in urging a protected nation. As a matter of fact, every ounce of armor plate, every ton of shell, protects the home and industry of EVERY citizen. These agitators against national preparedness would quickly discover, in the advent of hostilities, that the foresight and continuity of purpose of those dauntless men who are seeking to conserve that which is ours, made possible the strength to be unafraid.

Take it Out of Politics

THE announcement comes from Washington that the President intends to make another address to congress at an early date proposing that the tariff be divorced from politics. Why should it not be?

In the early days of the republic, there was a radical difference of opinion based on fundamental principles and those who favored free trade lined up against those who favored protection. As the years passed, however, the impossibility of enacting a purely free trade measure or one entirely of a protective nature developed and then appeared the tariff for revenue only advocates. But a tariff for revenue only could not be planned any more successfully than the other two varieties. Hence in recent years it has come to be appreciated that there are no simon pure free traders, no men who subordinate everything else to protection, and no men who can write a revenue measure which will not lean either toward protection or free trade.

Why then cannot all men agree on a bill which will raise enough revenue for our constantly growing needs, will protect American industries as much as they ought to be protected and yet will not permit American manufacturers to charge unreasonable prices? If this is to be done, the facts must first be ascertained. Let this be done as quickly as possible by the ablest men obtainable, men who will enter upon the investigation absolutely unbiased and with the determination to report the facts and make recommendations based on these facts and on nothing else. Then will it be the duty of congress to take these recommendations and mold a law which will give the country lasting peace from agitation about the tariff, which ought to be a matter of business and fair dealing and not of political theories.

Even the most partisan politician ought to be willing to assist in carrying out this program, for, if he has read the history of his country, he must know that passing tariff bills has brought defeat to more parties than anything else.

Prices Present and Past

Quotation on leading products December 22, average for November, 1915, average for September, 1915, and average for December, 1914. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices Dec. 22, 1915.	Aver. for Nov., 1915.	Average for Sept., 1915.	Aver. for Dec., 1914.
Bessemer pig iron, Pittsburgh..	$19.95	$17.45	$16.80	$14.70
Basic pig iron, Pittsburgh.....	18.95	16.70	15.65	13.45
No. 2 Fdy. pig iron, Pittsburgh	19.45	16.45	15.45	13.70
Northern No. 2 Fdy., Chgo....	18.00	17.12	13.80	13.00
Lake Superior Charcoal, Chgo..	19.25	17.50	15.95	15.75
Mall., Bess., Chgo.....	18.50	17.42	14.20	13.00
Southern No. 2, Birmingham...	14.50	13.50	11.50	9.50
Southern Ohio No. 2, Ironton..	17.50	16.25	14.50	12.63
Basic, eastern Pa.....	18.50	17.75	15.25	13.50
No. 2X Virginia furnace.....	17.25	15.50	12.75	12.50
No. 2X foundry, Philadelphia...	19.50	17.75	15.00	14.25
Ferro mang., Balti., (prompt)..	110.00	100.00	110.00	68.00
Bessemer billets, Pbgh.....	30.00	27.75	24.60	19.00
Bess. sheet bars, Pbgh.....	31.00	28.25	24.60	19.50
Op.-h'th sh. bars, Pbgh.....	31.00	28.50	25.80	19.50
Open-hearth billets, Pbgh.....	30.00	28.00	25.60	19.00
Steel bars, Chgo.....	1.99	1.79	1.54	1.20
Steel bars, Pittsburgh.....	1.80	1.625	1.34	1.10
Iron bars, Philadelphia.....	2.059	1.759	1.459	1.15
Iron bars, Cleveland, local del'y.	1.80	1.50	1.35	1.15

	Prices Dec. 22, 1915.	Aver. for Nov., 1915.	Average for Sept., 1915.	Aver. for Dec., 1914.
Iron bars, Chgo. mill.....	$1.75	$1.48	$1.31	$0.95
Beams, Chgo.	1.99	1.79	1.54	1.20
Beams, Pittsburgh	1.80	1.625	1.34	1.10
Beams, Philadelphia	1.959	1.759	1.509	1.20
Tank plates, Pittsburgh.....	1.80	1.625	1.32	1.07
Tank plates, Chicago.....	1.99	1.79	1.49	1.20
Tank plates, Philadelphia.....	2.159	1.759	1.509	1.20
Sheets, blk., No. 28, Pbgh.....	2.60	2.22	1.92	1.85
Sheets, blue an., No. 10, Pbgh.	2.25	1.85	1.52	1.35
Sh., galv., No. 28, Pbgh.....	4.75	3.906	3.67	2.85
Wire nails, Pittsburgh.....	2.10	1.87	1.69	1.55
Connellsville fur. coke, contr...	2.35	2.35	1.84	1.69
Connellsville fdy. coke, contr...	3.00	2.96	2.37	2.25
Heavy melting steel, Pbgh.....	18.00	15.31	14.25	10.30
Heavy melting steel, east'n Pa..	16.00	14.50	14.50	9.50
Heavy melting steel, Chgo.....	15.50	13.13	12.00	8.25
No. 1 wrought eastern Pa.....	20.50	17.00	16.00	11.50
No. 1 wrought, Chgo.....	15.50	12.75	10.75	7.50
Rerolling rails, Chgo.....	17.50	14.31	13.15	9.50
Car wheels, Chgo.....	14.75	12.73	11.75	10.00

(For Additional Prices See Page 1256.)

Freight Tie-Up Delays Shipments

And is Causing Much Trouble to Some Eastern Furnaces—Pig Iron Very Strong and Advancing

Philadelphia, Dec. 20.—Hold-ups of coke shipments en route by the general freight congestion on eastern railroads continues to project a new factor into the eastern Pennsylvania pig iron situation, and it is causing serious inconvenience for some producers. Recent storms have accelerated the trouble. A New Jersey furnace which has banked several times recently because of coke delays again was forced into temporary idleness the past week. An eastern Pennsylvania furnace may be banked in a day or two. Other furnaces are operating on the ragged edge as their stocks of fuel are lean. Several furnaces which were about to be blown in have been delayed by the failure of coke to arrive. Shipments of iron into this territory have not been seriously interfered with nor have the foundries generally suffered from any coke shortage. The iron market remains very strong, but is quieter, the approaching holidays probably being a factor. For No. 2X foundry, $19, eastern Pennsylvania furnace, or $19.50 to $19.75, Philadelphia, remains the usual price, but lower is reported on some grades. Some makers now have withdrawn $19 as an open price and are considering each inquiry by itself. A $20 furnace price for first half or beyond seems easier to obtain. Four or five makers have sold at that figure. One has taken several thousand tons more, mainly for second quarter. Two central Pennsylvania makers have raised to $20 for first half. Over 1,000 tons of Buffalo No. 2X have been sold into that territory at $20.78, delivered, or $17.75, furnace for first half. A Delaware river pipe maker closed for 3,000 to 4,000 tons of early forge at a reported price of $18, delivered. Virginia prices still rise. The Virginia Iron, Coal & Coke Co. has advanced $1 for last half to $18, furnace, for No. 2X, $17.50 for 2 plain, $17.25 for No. 3 and $17 for No. 4 and forge. One maker has jumped 2X to $18.50, third quarter and to $20.50, fourth quarter, to shut off selling. Special Virginia grades this week brought $18.50, furnace, for early delivery and spot regular grades $18. The Norfolk & Western railroad is distributing this week orders against a practically 10,000-ton inquiry for last half. In basic, a Burnham, Pa., consumer continues to figure on 6,000 tons first half and another buyer is feeling the market. Some makers ask $19, furnace, for this grade, but the market is untested. Further selling of low phosphorus into the last half has been done. One buyer took 2,500 tons for late first half to September at $30, furnace, or $32.62, Philadelphia basis. Another sale of 600 tons for first half was made at the same figure. Lebanon iron for last half has been sold at $32, furnace. It is understood, however, that one maker has sold for last half $2 a ton below first half. An inquiry for 3,000 tons is out. A Pottstown, Pa., buyer took 1,000 tons of malleable for March-April at about $20.78, delivered. Another Lackawanna furnace at Lebanon has gone in and the Emporium furnace will resume about Jan. 1. In Virginia, Dover is about to go in and another Crozier and Radford later.

(*For complete prices see page* 1256.)

Buffalo Prices Stronger

Buffalo, Dec. 21.—The same wide spread in quotations on iron in the Buffalo market continues on account of the presence of resale iron being offered at a lower figure than the prices being asked by the furnace interests that are sold up practically solid over the first half of 1916. The minimum on the lower grades is $17.50 at the furnace against a firm maximum of $20 for all grades being asked

by the producers not having resale iron on their yards.

The sales for the week, made up to a large extent of resale iron, amounted to fully 30,000 tons of all grades. The view of the market varies according to the different producers of the district. Some report a light inquiry with small sales for the week, while others report an increasing demand with heavy sales being made.

There has been an effort for some time on the part of a number of leading melters to cover for their needs over third quarter and possibly last half of the coming year, but such overtures, for the most part, have been discouraged by the furnaces. It is said, however, that a limited amount of business has found its way on the furnace books for last half needs. Furnaces decline to discuss this phase of the market or to affirm or deny reports that last half tonnage has been booked where competitive bidding was left out of the transactions.

The heavy sales of iron on the yards bought in the spring against the anticipated heavy demand, are wiping out the stock of resale iron. With the disappearance of the speculative tonnage, it is believed prices will sharply advance to the present maximum of $20 at least.

Exports are Blocked

New York, Dec. 21.—Blockaded shipments of coke, especially, and in some measure of pig iron, because of railroad embargoes, are causing the iron trade in metropolitan and New England territory the most concern at the present time. Within the past two days, the situation as to New England has been improved by the New Haven road removing its embargo and accepting new freight from western lines, but the ban on practically all incoming shipments to New Jersey points taking lighterage remains in force on all except one or two roads and many consumers are completely shut off. The holding up of coke shipments has caused much trouble for the foundries and while actual shut-downs have not been numerous, these have been staved off by melters borrowing among themselves and by new spot purchases of fuel which they were able to make. Sales of many carloads of Connellsville spot foundry coke have been forced the past week at $6.35, delivered New Jersey points, $6.85 Brooklyn, and $7.50 New England. Some of the furnaces also are suffering and the Oxford, N. J., stack has been banked because of coke shortage. Export business in pig iron is completely blocked by the present embargoes.

New sales of iron have not been heavy the past week, but several round tonnages of foundry grades were closed quietly and others are in negotiation. A sale of 1,500 to 2,000 tons of first and second quarter basic was made into this territory from eastern Pennsylvania maker at about $18.75, delivered; a Newark soil pipe maker took several thousand tons of No. 2X, No. 2 plain and No. 3 for last half at a reported average price of $19 to $19.50, delivered. Some of the No. 2X is reported to have been sold at $19.30, delivered. The American Locomotive Co. took 600 tons of low silicon. One sale of 1,000 tons of No. 2X for first half and others for smaller amounts were made at $20, eastern Pennsylvania furnace, or $20.79, tidewater. A Chrome, N. J., steelmaker is inquiring for 5,000 to 10,000 tons of low phosphorus for all 1916. One lot of several thousand tons of low phosphorus was closed here. The Virginia Iron, Coal & Coke Co., which several days ago advanced to $18, furnace, for No. 2X for last half, now has put its price for first quarter and half to $17.25 and for all second quarter to $17.50.

Pig Iron Quiet

Pittsburgh, Dec. 21.—Pre-holiday dullness characterizes the market for pig iron in western Pennsylvania and eastern Ohio. Scattering small lots of steelmaking and foundry pig iron grades have been sold this week at current market prices, but no large tonnages have been involved. One dealer has sold several small lots of bessemer pig iron at $20, valley, but the market for this grade has not been severely tested. Embargoes against the shipment of pig iron and finished products to New York seriously have affected some consumers partly dependent upon valley blast furnaces for their supplies, and complaint is heard about deferred shipments to the north and west of Pittsburgh. The Carnegie Steel Co. is blowing 50 of its 59 blast furnace stacks.

Prices Advanced Along Lake

Cleveland, Dec. 22.—The pig iron market is extremely strong. The tonnage available for purchase is not large. The price of No. 2 foundry, basic and malleable, Cleveland, has been advanced 50 cents and is now $18.50, furnace, or $18.80, delivered in the city. A small tonnage has been sold at this figure. At Detroit, sales have been made at about $19.25, delivered, while at Erie $19 has been paid for malleable and the price is expected to advance to $19.50. Cleveland interests having foundry iron to sell in the valley are quoting $19, valley. Inquiry for last half delivery is more persistent, but furnaces are firm in their determination not to quote for delivery after July 1.

Much Buying in Chicago

Chicago, Dec. 21.—Activity marks the closing days of the year in pig iron and large inquiry is being received, with unusual buying for this period of the year.

Malleable iron has become scarce and cannot be obtained easily for first half delivery. A number of melters have bought heavily for first half and some have covered for last half delivery as well. This tonnage has been closed at $18, Chicago furnace, and on the crest of the buying prices have been advanced to $18.50, furnace, all dealers asking this for first half and one interest being willing to assume tonnage for second half delivery at the same rate. Other sellers are not quoting on second half.

Foundry iron remains 50 cents per ton lower than malleable and the same condition as to last half contracts exists. Inquiry for the most part is for small tonnages, well scattered. The Allis-Chalmers Co. has bought at least 8,000 tons of foundry iron recently for delivery during second quarter and second half at a price understood to be $18, Chicago, for use at its Milwaukee plant. The American Car & Foundry Co. is understood to have closed for about 2,500 tons of malleable for St. Louis delivery at $19.50, delivered.

Southern iron has developed much strength recently and $15, Birmingham, seems to be the minimum for first half delivery, with some interests asking as high as $16 for second half, though general buying for the later option is not general.

Chicago furnaces are booking a large aggregate tonnage, though in small lots. Most of the selling is for first half and capacity is being filled rapidly. Some tonnage is being booked for second half, though it is not being sought by sellers and some interests are not quoting beyond the middle of the year.

Iroquois Furnace Co. is getting its two remaining stacks in condition for lighting and will put them into service as early in the spring as conditions will warrant. Short ore supply is one of the deterrents.

Southern Iron Higher

Cincinnati, Dec. 21.—The southern pig iron market continues on the upgrade. No. 2 foundry is now being

(*For complete prices see page* 1256.)

held by a few furnaces at $14.50, Birmingham basis, for the first half, and others have advanced to $15 for the same delivery. One stack, which has declared itself out of the market, is holding at $15.50, Birmingham basis. Southern Ohio No. 2 foundry iron is unchanged at from $17.50 to $18, Ironton basis, for first half shipment, but indications point to the establishment of $18 as the minimum quotation before the end of the year. Virginia iron has been advancing spasmodically during the past few days. Today No. 2X is quoted at $17.25, furnace, for the first half, $17.50, furnace, for the second quarter alone, and $18, furnace, for the last half of 1916. Silvery iron is unchanged at $25, furnace, for 8 per cent silicon, for second quarter shipment, including makes from Jackson, O., and Ashland, Ky. None of this grade is available for the first quarter. Sales in this district are light, but are reported heavy in surrounding territories. A St. Louis melter has taken 3,000 tons of malleable iron, and another in the same city has purchased 3,000 tons of basic iron from Chicago stacks. An Indiana user is inquiring for 3,000 tons of malleable iron, and the Jeffrey Mfg. Co., Columbus, O., is out for 3,000 tons of malleable iron and 2,000 tons of foundry iron.

More Activity

St. Louis, Dec. 21.—Two sales, each for 3,000 tons of malleable iron, last week, and a number of sales of from 200 to 400 tons, brightened the market considerably, and with numerous inquiries ranging from 200 to 500 tons in the mails today, would seem to indicate that business is picking up to a degree unexpected so near the stock-taking time of the year.

Prices are stiff, too, and southern iron is held firm at $15 to $15.50, Birmingham, for first half delivery. One sale of 400 tons of southern was made at the higher figure Saturday. Northern iron is quoted at $18 to $18.50, Chicago, and at $18, Ironton.

Cold Rolled Steel

Buffalo, Dec. 21.—Cold rolled steel has been advanced by the mills and agencies of the district to 45 per cent off for carload lots and to 40 per cent off for less carload orders. The demand continues strong.

More Open Hearths.—A battery of six additional open hearth furnaces has been completed at the Lehigh plant of the Bethlehem Steel Co., South Bethlehem, Pa. This additional steelmaking capacity has been built in connection with the installation of several merchant bar mills in the Lehigh plant. These mills have been in operation for several months. The new furnaces will increase the number of such units in the entire Bethlehem Steel works to 33.

Lake Iron Ore

Will Probably be Sold in Large Tonnages in the East

Cleveland, Dec. 22.—The selling of lake ores has continued at a moderate rate during the past week and sellers are encouraged to believe that fairly large tonnages of lake ores will be taken by eastern furnace operators, following the example of Mr. Dinkey, who recently purchased a large block for the Midvale Steel & Ordnance Co. Although it is true that local mines in the east are being worked more actively than ever before, there is much uncertainty concerning the shipments of ore from Cuba and from European countries on account of the high freight rates and scarcity of boats. Hence it is believed that eastern consumers will be compelled to use large tonnages of lake ores.

High Ocean Freights

New York, Dec. 21.—High ocean freights continue to place transatlantic iron ore out of the pale of competition in the eastern Pennsylvania district and practically no material other than that of special quality now is being offered seriously. An illustration of the extraordinary ocean freight rates from the Mediterranean now prevailing is the coal chartering to Italy at 90s against a normal rate of about 11s. These lucrative rates are causing vessel owners to ignore such low grade cargoes as iron ore, on return voyages, owing to the delays that are incident to this traffic.

Ferro is Higher

Pittsburgh, Dec. 21.—Sellers of 80 per cent ferro-manganese are asking advanced prices for prompt and future delivery. Sales at $112 and above at the eastern seaboard are reported. The market this week, however, has been quiet. Lower grades of ferro-silicon for first quarter delivery are being held at $1 a ton above the price for second quarter shipment. Fairly heavy demand for spiegeleisen is reported and specifications for steelmaking metals are brisk. Prices of metals continue nominal. Large premiums are being offered for all grades of special steel for nearby shipment.

(*For complete prices see page* 1256.)

Coke Strong

Prices for Spot Delivery Higher Than Ten Days Ago

Pittsburgh, Dec. 21.—Connellsville coke for spot delivery continues to sell at prices ranging from 50 cents to $1 a ton above those representing the market 10 days or a fortnight ago. Some blast furnace fuel for immediate shipment has been sold at $3.65, ovens, and the market appears to be quotable at a spread from $3 to $3.50, ovens. Foundry coke is selling at a spread from $3.75 to $4 a ton at the ovens.

The market for spot delivery may become even stronger as the end of the year approaches, since it is likely that the output of ovens in the upper and lower Connellsville regions will be reduced considerably during the holidays. Congested traffic conditions are interfering seriously with shipments of fuel to the north, east and west of Pittsburgh. The *Connellsville Courier* for the week ending Dec. 11 says production was 451,896 tons, an increase of 14,645 tons, compared with the week before. Production for the week ending Dec. 11 was the heaviest recorded for any seven-day period this year.

Need More Foundry Grades

Cleveland, Dec. 22.—Foundries continue to buy coke for prompt delivery and $4, ovens, for such delivery is now the minimum and one company is asking $4.15. The heavy melt calls for a considerable increase in coke.

Prices Advancing

Cincinnati, Dec. 21.—Coke prices are gradually becoming stronger. Production is now below consumption, and labor shortage in the coke fields has handicapped oven operators from increasing their outputs. Demand for coal is also heavy at present, and large tonnages are being shipped instead of turning it into coke. Wise county furnace grades have advanced and are now quoted at from $2.85 to $3.10, ovens; and foundry coke for that district is quoted at from $3.25 to $3.50, ovens. Pocahontas foundry coke is unchanged at from $3 to $3.25, ovens, and furnace coke from the same fields is given at from $2.75 to $3, ovens.

New River prices are 25 cents a ton above those given for Pocahontas grades.

Dull at St. Louis

St. Louis, Dec. 20.—Coke is dull, and very little in demand. Connellsville and Virginia foundry grades are held at $3.50, ovens.

Great Steel Bar Tonnages

Are Pending—One Inquiry Calls for 250,000 Tons of Rounds for Shell Manufacture

Philadelphia, Dec. 20.—Active inquiries for finished and semi-finished rounds for shell manufacture for last half now are coming out quite briskly and eastern Pennsylvania makers have before them several hundred thousand tons. One maximum requirement calls for 250,000 tons. Practically all these inquiries are for direct export, with France the leading buyer, and the round sizes asked are 4, 5, 6, 7 and 8-inch. The shrapnel sizes are in the least tonnage, as the steel mainly is wanted for high explosive shells. Some makers have been asked to quote on an open tonnage, representing what they can supply for last half. Against the report that some large mills will accept tonnages of rounds for last half at less than 3.00c, mill, is the announcement that one maker has taken a contract for that period at considerably over 3.00c, mill, and an eastern company sold for July at 3.60c, mill. The last half market remains to be clearly determined, as sellers are going slowly. Some shell bar inquiries to domestic manufacturers continue to come out. An eastern Pennsylvania company still figures on 30,000 tons of 7¼-inch squares, British specifications, for shipment from March to Jan. 1, 1917. Another company in this district wants 1,300 tons of 2½ and 4-inch squares for January-April. A local buyer closed for 1,000 tons of large rounds for comparatively early delivery at 3.00c, Pittsburgh. The Baldwin Locomotive Works recently bought 5,000 to 10,000 tons additional. The makers are promising no deliveries before July to the regular bar trade, but where small lots have been slipped in before that date, 1.80c, Pittsburgh, or 1.959c, Philadelphia, was obtained here.

Steel Bars Active

Pittsburgh, Dec. 21.—Manufacturers of steel bars are constantly being urged to book additional tonnages and to ship against contracts placed some time ago. Demand for rounds for the manufacture of shrapnel shells and other war material is heavy and the domestic situation has been growing more satisfactory the last 60 or 90 days. Bar iron is being held at 1.90c and above by mills in the Pittsburgh district.

Steel Bars Scarce

Chicago, Dec. 21.—Little comment is possible on the situation in steel bars, as well as in other finished steel products. Buyers find the utmost difficulty in finding a seller able to take on additional tonnages and most inquiries meet firm refusal of consideration. A number of instances have been met recently in this market where tonnages of 1,000 to 1,500 tons have been refused when price and delivery have not been a determining factor on the part of the buyer.

Some inquiriers are willing to have their tonnages booked for delivery at the convenience of the mill, as late as August and September as tentative dates being acceptable. Ordinarily this is not being taken, as the option is too far extended.

Nominally steel bars are quoted at 1.99c, Chicago, but such bars as are being sold are at a premium, 2.19c being a moderate figure.

Bar Iron Firm

Chicago, Dec. 21.—Bar iron continues firm at 1.75c, Chicago mill, with excellent demand. Mills for the most part are not anxious to sell far into the future and commitments are being taken for January and February, though some of this will lap over into March. First quarter tonnage promises to be absorbed in this way without any definite buying movement.

Mills will not close for a holiday recess as usual, the only break in operations being on Christmas day, pressure for delivery and large rolling schedules making this necessary.

Difficult to Quote

Cleveland, Dec. 22.—It is difficult to quote the price of bar iron accurately in the Cleveland district. Mills have taken all the orders they care to book for the present, and, owing to the high price of scrap, are not buying any more of that material but are awaiting developments.

Specifications Heavy

Buffalo, Dec. 21.—Mills and agencies of the Buffalo district report that specifications, amounting to two to three times the rolling capacity of the mills, are pouring in, making the demand for material under contract the heaviest in a long time. A larger tonnage has been ordered out than in any week in the last half.

The mills, in the matter of proferred new tonnages, are taking a firmer stand than heretofore in declining new business. This situation applies to shapes and plates as well as to bar materials.

Customers of long standing, it is reported, have been turned down where they have sought to get on the mill books additional tonnages to come forward with specified sizes, even where the users have been ready to pay from $10 to $15 per ton higher than the figure at which the material under contract was placed by them earlier in the year.

The mills are devoting their energies to get out tonnages for customers specified months ago, waiving the question of endeavoring to squeeze in rollings on sizes possible to book at the present time at prices far in advance of the basis on which the contract tonnages were taken.

The mills and agencies report that the absolute minimum on bars, and on shapes and plates as well, is 1.80c with a number of the producers declining more business at this level.

No specific deliveries are being promised. The only business that is being accepted is strictly at mills' convenience, and then only to accommodate established customers.

(For complete prices see page 1256.)

Hoops, Bands and Shafting

Pittsburgh, Dec. 21.—Manufacturers of cold rolled steel shafting, Dec. 20, advanced prices $5 a ton to 45 per cent off the list for carloads and 40 per cent off the list for less than carloads. These prices were adopted as a protective measure, since makers are not in a position to offer material for shipment in less than six months. Hoops and bands last week were advanced $2 a ton to 2c and 1.80c, respectively. Demand for both products is described as heavy. Cold strip steel quotations are considered nominal, it being apparent that no material is obtainable at 3.50c, base. Some makers have been refusing to sell at 4c, base.

Nuts, Bolts and Rivets

Pittsburgh, Dec. 21.—Prices of nuts, bolts and rivets are expected to advance shortly to meet higher prices of steel bars, which were advanced $2 a ton last week. Demand for nuts and bolts is heavy and rivet manufacturers are driving plants at maximum capacity to meet specifications for delivery. Some tonnage for export has been sold this week.

The Orcutt Pipe Co. has been incorporated at Toledo, O., with a $15,000 capital stock. F. J. Orcutt, F. F. Lavoy and L. J. Neuhausel are the incorporators.

Discourage Plate Buying

By Quoting High Prices, But Consumers Continue Active in the Market

Philadelphia, Dec. 20.—Makers own prices on plates continue to be obtained by eastern Pennsylvania mills and 2.25c, Pittsburgh, or 2.409c, Philadelphia, for any shipment during the first quarter is being quoted by all producers. One maker who is so filled that all inquiries are being considered individually is naming this price only to preferred regular customers and to outsiders 2.75c, Pittsburgh is quoted to discourage purchases. Furthermore some mills now are putting into effect extras which heretofore have not been insisted upon. One of these is for cutting small widths for which 1½ cents per pound extra has been established. Buyers in many cases are consuming at such a rapid rate that high prices do not deter them in ordering steel. An interesting incident concerns a very large eastern consumer who closed in October on a first quarter contract for 3,000 tons. This contract already has been specified in full and the buyer now is paying $11 a ton over the original contract price for the tonnages that are being overspecified. The Harlan & Hollingsworth Corporation has received a tank ship from the Vacuum Oil Co. and also has been awarded a freighter for another interest. The Vacuum Oil Co. placed two tankers with the Union Iron Works, San Francisco. The Maryland Steel Co. has inquired for 6,000 tons of plates for last half.

Plates Not So Active

Pittsburgh, Dec. 21.—The advent of the Christmas holidays has tended to reduce new demand for finished steel products. Mills have not opened books for third quarter delivery and it is not likely that much new tonnage will be sold until consumers are able to cover third and fourth quarter requirements. The Carnegie Steel Co., the Jones & Laughlin Steel Co., the Cambria Steel Co. and other western Pennsylvania makers advanced the price of steel plates, shapes and bars last week to a minimum of 1.80c for delivery at the convenience of the mill. In a great many cases, this necessarily means for shipment after July 1, since the output of most mills has been sold ahead five or six months. Specifications for plates show no diminuation. Because of the high price of car material, leading railroads have not definitely considered buying programs for 1916. Mills in a position to meet specifications for quick deliveries are selling material at as high as 2.25c and even 2.40c.

One Mill Not Quoting

Cleveland, Dec. 21.—One Cleveland mill has taken all the orders for plates and sheets that it cares to take for the present and is not making any quotations. Another mill is quoting on a basis of 2.50c, Pittsburgh, on plates, which is now the minimum. Mills are so well supplied with orders that they are very conservative about taking on additional business.

Continue Scarce

Chicago, Dec. 21.—Steel plates continue to be scarce and are commanding better premiums than other finished steel products. Active demand from ship and car building concerns is responsible for this and mills are taking little tonnage, some sellers having a few to sell and taking large advances over the nominal quotation of 1.99c, Chicago.

Cast Iron Pipe

Prices Are Again Advanced in Chicago District

Chicago, Dec. 21.—Cast iron pipe advanced again last week, the minimum disappearing and business moving to the maximum quotation, $28 to $30, Chicago, for 6-inch and larger and 4-inch respectively. Cities are not yet in the market for next year's pipe, but a flood of inquiries is expected after January appropriations are made.

Bids were to be opened today at Blue Island, Ill., on 419 tons and at Muscatine, Ia., Dec. 24 on 400 tons.

Will Operate Diamond Plant

The Delaware Steel & Ordnance Co., capitalized at $10,000,000, par value $100, is the style of the corporation which will operate the old works of the Diamond State Steel Co. at Wilmington, Del., now undergoing rehabilitation. Incorporation of the new company recently was affected in an eastern state. Daniel J. Driscoll and H. T. Wallace, of the Delaware Seamless Tube Co., Auburn, Pa., are among those heading this project. The renovated works is to roll steel rounds, blooms, etc., for shell manufacture and some business with European countries at war now is under negotiation. It is expected that operations will be inaugurated within 60 days.

(For complete prices see page 1256.)

Wire Advanced

To Highest Prices in Years—Cut Nails Also Moved Up

Pittsburgh, Dec. 21.—Under date of Dec. 21, the American Steel & Wire Co. and other manufacturers of wire products advanced prices of all products, except galvanized wire nails, $2 a ton to a basis of $2.10 a keg for wire nails, the highest figure to prevail since the early part of 1901. Wire products now are quoted at from $12 to $13 a ton above prices prevailing 12 months ago and galvanized material is selling at a 70-cent differential as against a 40-cent differential obtained last year. Wire fencing was advanced one point to 67½ per cent. Cut nails also have been advanced $2 a ton to $2 a keg. The prevailing schedule of prices follows: Wire nails, $2.10 a keg; plain wire, $1.95; galvanized wire, $2.65; polished staples, $2.25; galvanized staples, $2.95; painted barb wire, $2.25, and galvanized barb wire, $2.95 per 100 pounds to jobbers. Galvanized nails, 1-inch and longer, continue to be offered at $2; galvanized nails, shorter than 1 inch, are listed at $2.50. At least one mill is reported to be booking contracts for extended delivery at prices to be determined at the time material is shipped.

Warehouses Advance Shafting

Cleveland, Dec. 22. — Warehouse business continues very active, but the only advance announced is on shafting, which now is quoted 35 off instead of 40 off, an advance of $5.

An Active Plant.—Blast furnace No. 2 of the Pennsylvania Steel Co., at Steelton, Pa., is about to be blown in, which will make active the entire Steelton group of five furnaces of the company for the first time in a number of years. One of these is the No. 5 furnace, which was blown in in September. This is a modern plant which was designed and built by the engineers of the company and it has a capacity of about 500 tons daily. The Lochiel furnace of the company continues idle.

Sell Shapes at Two Cents

High Prices Quoted by Eastern Pennsylvania Mills—Large Tonnages Taken for Industrial Additions

Philadelphia, Dec. 20.—Some sizeable tonnages of standard shapes are being taken at the high prices which eastern Pennsylvania makers are quoting. An important eastern buyer placed 2,000 tons of large sizes for delivery as the mill is able, or in one to three months, at 2.00c, Pittsburgh. This is the price eastern mills generally quote on standard shape business in their regular territory, and 2.25c, mill, is asked to western buyers for shipment as their schedules will allow, but special sections are available for comparatively early delivery at 1.80c, Pittsburgh, or 1.959c, Philadelphia. New fabricated jobs in this district are of lighter volume. The American Bridge Co. has been taking most of the important tonnages recently offered, its assured shape supplies apparently being to its advantage. The Maryland Steel Co. has inquired for 6,000 tons of last half shapes. The Lenoir City, Tenn., car builder has closed for 1,000 tons of angles, probably with a southern mill.

Structural Shapes 1.80c and Above

Pittsburgh, Dec. 21.—Leading makers of structural shapes last week advanced prices $2 a ton to 1.80c as a minimum for shipment at the convenience of the mill. Reports that leading manufacturers had opened books for delivery after July 1 next, officially are denied. Specifications for structural shapes are decidedly heavy, but new buying is not so active as the end of the year approaches. Fabricating shops are operating at maximum capacities.

Few New Buildings

Cleveland, Dec. 22.—With 1.80c, Pittsburgh, as the minimum quotation, the shape market is very firm and several inquiries from manufacturers of ore handling machinery and other manufacturers for shapes, plates and bars are pending, involving several thousand tons, but the demand for structural material for new buildings continues light.

Structural Lettings Improve

Chicago, Dec. 21.—Industrial building formed the feature of structural lettings in the west during the past week, practically every item of an unusually large tonnage being for some form of manufacturing plant. Fabricators are finding their shops well filled for a long time ahead and the situation is comfortable. Structural shapes are quoted at 1.99c, Chicago, a nominal figure, with premius for delivery where it is possible to supply material within a few months.

Steelmakers are accepting contracts for structurals for definite projects even though delivery is to be in last half.

CONTRACTS AWARDED.

Plant extensions for Illinois Steel Co. at South Chicago, 7,035 tons, to American Bridge Co.

Smelter, Ajo, Arizona, for Calumet & Arizona Mining Co., 2,500 tons, to Kansas City Structural Steel Co.

Sanitary District of Chicago, bridges for Calumet Sag channel, 1,050 tons; 670 tons truss spans to Milwaukee Bridge Co., 380 tons girder spans to Chicago Bridge & Iron Co.

University of California, addition to library building, 1,000 tons to Pacific Rolling Mill Co.

Armour & Co., building for soap works, U. S. Yards, Chicago, 900 tons, to Hansell-Elcock.

Great Western Sugar Co., Factory building, Gering, Neb., 750 tons.

City of Chicago, Ninety-fifth street incinerator, 350 tons, to North Works, Illinois Steel Co.

Corn Products Refining Co., addition to building No. 29, Argo, Ill., 350 tons, to South Halsted Street Iron Works.

Buildings for the Buick Motor Co., Flint, Mich., 2,200 tons, awarded the American Bridge Co.

Buffalo General Electric Co., Buffalo, new steam-electric power generating station, 2,000 tons additional, making total of 4,000 tons, awarded to Lackawanna Bridge Co., Buffalo.

Lukens Iron & Steel Co., Coatesville, Pa., new open-hearth plant, producer building, and loading and unloading trestle, 4,000 tons, contract to Lackawanna Bridge Co., Buffalo.

Hooker Electro-Chemical Co., Niagara Falls, N. Y., plant addition, 300 tons, contract to Ferguson Steel & Iron Co., Buffalo.

General Railway Signal Co., Rochester, plant addition, 150 tons, to Ferguson Steel & Iron Co., Buffalo.

May Build at Cleveland

The American Steel & Wire Co. is considering the erection of a by-product coke oven plant at the Central furnaces, Cleveland, but decision has not yet been made. The report that the company would build a by-product plant at Donora has been denied.

Scrap is Strong

New York, Dec. 21. — Wrought and cast scrap are the leaders in a strong old material market in this territory. No. 1 railroad wrought is quoted around $19 New York and wrought pipe up to $13.50 New York. New Jersey foundries are paying $15 to $15.50 delivered for No. 1 heavy cast and stove plate and grate bars are higher in sympathy. Steel for eastern Pennsylvania delivery remains quiet but for the Pittsburgh territory, $18.50 delivered, is offered.

(*For complete prices see page* 1256.)

Nothing to Sell

Valley Makers Will Have No Billets for Several Weeks

Youngstown, O., Dec. 21.—The iron and steel markets are spectacular with producers sold up, record production, heavy specifications and steadily upward tendency of prices, but there appears no outstanding feature. Inability of sellers to take on much more tonnage for nearby delivery, together with the approaching holidays, gives the market almost an appearance of dullness.

Valley makers of semi-finished steel will have no material to sell in the open market for from three to six months. Regular customers will get material, but perhaps not as much as they may want. First quarter requirements are covered, and second quarter business is expected shortly after the first of the year. What prices will be paid for second quarter billets and sheet bars is not even hinted at. Published quotations for both open hearth and bessemer billets and sheet bars are wholly nominal.

Independent makers of wire products are adopting the $2 a ton advance in nails and plain wire announced by the leading interest this week, but are booking little additional business. Further advance in pipe is expected in the near future, as prices of this description have not changed since Nov. 1 while steel costs have advanced appreciably and demand is broad in volume. The market for plates and shapes is nominally 1.80c to 2c for prompt delivery, with makers sold for many months ahead. The sheet market is active, except in the case of galvanized sheets, which are the one description lagging in the iron and steel procession.

Some inquiry still is coming out for bessemer and foundry pig iron. It is believed that the next pronounced buying movement will send bessemer to $20. Most consumers of foundry iron are covered for the first half, although there is some second quarter tonnage still out. Some inquiry has been in the market for pig iron for delivery the second half of 1916, but sellers are not committing themselves that far ahead. No new developments in the matter of export inquiry for iron are reported.

Blue Annealed Sheets High

And Leading Companies Are Out of Market—Galvanizing Departments Suspend Operations

Youngstown, O., Dec. 21.—Demand for blue annealed sheets, of record proportions for months, has broken its own records the past few days. Large new inquiries for both foreign and domestic account have come into the market, apparently far in excess of the capacity of the comparatively few mills which are equipped to roll all sizes. As a result, differentials between black and blue annealed sheets have almost disappeared. Blue annealed sheets are quoted 2.30c to 2.50c on the basis of No. 10 gage, Pittsburgh, while black sheets are quoted 2.60c to 2.75c on the basis of No. 28 gage, Pittsburgh. Normally, with black sheets selling at 2.60c, blue annealed sheets would be quoted around 2.15c. Under present conditions, No. 16 gage blue annealed, selling at an advance of 20 to 30 cents a hundred over the base, are quoted at a higher level than No. 16 gage one pass cold rolled and annealed sheets, which sell at 25 cents a hundred under the base. The demand for black sheets continues in heavy volume, but most makers are not selling much further ahead than 60 days, and practically nothing seems to have been for the second quarter.

The galvanized sheet market is almost lifeless. In general, galvanizing departments have practically suspended operations, while demand is at a minimum. This branch of the industry seems more affected now than at any time this year. Producers say the only safe way to quote galvanized sheets is to compute all costs carefully, then add $5 a ton for risks. The minimum at present spelter prices is about 5c for No. 28 gage, Pittsburgh.

Blue Annealed Scarce

Cleveland, Dec. 22.—The American Sheet & Tin Plate Co. and other companies are entirely out of the market on blue annealed sheets and it is extremely difficult to obtain this kind of sheets. A report was current that one company had refused an order for 5,000 tons at 3c per pound, but this report has been denied. It is within the possibilities, however, that 3c could be done, if anyone had a large tonnage for sale. The last quotation made by one Cleveland mill was 2.55c and it is now out of the market. On black sheets, conditions are slightly easier. The American Sheet & Tin Plate Co. quotes 2.60c on bessemer No. 28 and 2.70c on open hearth. There is very little galvanized obtainable and the usual quotation is 5c.

Black Sheets Advanced

Pittsburgh, Dec. 21.—The American Sheet & Tin Plate Co. and other manufacturers of bessemer black sheets have put up prices $2 a ton to 2.60c for No. 28 gage and some tonnage is commanding $3 above that figure. Galvanized and blue annealed sheets show no change in position. Demand for future delivery is increasing in volume, but most mills are not selling for extended shipment, because of the uncertainty of future supplies of sheet bars and acid. Mills will enter the new year with decidedly heavy backlog tonnages on their books and indications are that the first six months of 1916 will continue very active.

Demand Increasing

Chicago, Dec. 21.—Users of steel sheets are beginning to become somewhat nervous over their supply for the future. Sheet mills are not burdened by orders and, as far as ability to roll is concerned, can turn out all that will be required. The only drawback is in obtaining sheet bars for rolling. Mills can use their entire output of steel for other purposes at good prices and this may have some effect on the outcome.

No. 28 gage black sheets are quotable at 2.69c, Chicago, and upward. This figure promises to disappear shortly, as the bulk of sales seems to be going at 2.79c, Chicago.

Galvanized sheets continue to soar and prices are in the neighborhood of 5c, Chicago, with little call from consumers who can use other material.

Prices Strong

Cincinnati, Dec. 21.—Lack of buying that usually precedes the holiday season is being felt in the sheet market here, but prices are very strong and unchanged. Sheet mills in this district do not seem inclined to solicit orders, and are selling for prompt delivery only, because of the uncertainty of conditions after the first of the year. Black sheets No. 28 gage are quoted at 2.65c, galvanized No. 28 gage at 5c, and blue annealed No. 10 gage at 2.30c, all Pittsburgh basis. Warehouse prices are as follows, Cincinnati basis: Black No. 28 gage, 3c; galvanized No. 28 gage, 5.25c, and blue annealed No. 10 gage, 2.65c to 2.70c.

(*For complete prices see page* 1256.)

Another $2 Rise in East

Philadelphia, Dec. 20.—Blue annealed sheets now are quoted by eastern Pennsylvania makers at a minimum of 2.50c, Pittsburgh, and 2.659c, Philadelphia, for No. 10 gage, an advance of $2 a ton. A number of contracts for second quarter have been booked at this figure. There are inquiries in the market for last half but producers are not quoting. Practically no tonnage is available from eastern makers for first quarter. Specifications are very liberal.

Tin Plate Price Hardens

Pittsburgh, Dec. 21.—Manufacturers of tin plate express the belief that prices will advance about $3 a ton shortly after Jan. 1 to $3.75 for 100-pound cokes. The prevailing $3.60 price is being well maintained. Most mills are rolling tonnage ordered before the $3.60 price was adopted at the opening of the 1916 season. Demand for tin plate for export is heavy and a number of attractive tonnages have been placed recently.

Advance Expected

Youngstown, O., Dec. 21.—Tin plate makers are not taking on any more tonnage than they can help for delivery over 1916 at the recently announced price of 3.60c per 100 pounds, for they expect another advance will be announced before the new year is very old. Foreign demand continues abnormal. It is believed at least 20 per cent of the present production is being exported. In spite of the protest of certain large consumers at the recent advance in prices, who apparently do not follow the trend of the iron and steel markets, it is pointed out that present quotations are not abnormally high. In 1911, tin plate was quoted 3.70c, in 1900 4c and in 1899 4.65c.

Pipe Market Quiet

Pittsburgh, Dec. 21.—No large orders for iron or steel pipe have been placed this week. Specifications are coming out in heavier volume and talk of an advance in the price of standard steel and iron pipe is heard. The market for boiler tubes and seamless tubing is very active and prices are well maintained.

Fire in the office of Craig Ridgway & Son, Coatesville, Pa., recently badly damaged the interior of the building and destroyed many valuable papers.

Scrap Advances

Higher Quotations in Some Centers—Activity is General

Philadelphia, Dec. 20.—Active demand for practically all grades proceeds in the eastern Pennsylvania old material market and prices still tend strongly upward. Shafting and wrought pipe have moved up sharply, the former to $22.25, delivered eastern Pennsylvania, on actual sales and the latter to $15.25, delivered, with the brokers now bidding $15.50, delivered. Wrought scrap generally remains very buoyant. No. 1 yard wrought was sold in the week at $20, delivered, small amounts figuring, while No. 1 railroad is at $21, delivered, and upward. Small sales of No. 1 heavy cast have been made at $17, delivered. The heavy melting steel market still shows an absence of the works as buyers, but the brokers continue to offer $16, delivered, and are not collecting much tonnage at that figure. The mills probably would be obliged to pay a considerably higher price for any sizeable tonnage in view of the present wide spread between the eastern and Pittsburgh markets on steel scrap.

Prices Advance

Buffalo, Dec. 21. — Old material prices in the Buffalo district have shown a sharp advance in the past 24 hours. Trading in practically all of the lines has been heavy during the past week and dealers report a continuance of the general demand. The articles in the list to advance $1 per ton over the prices quoted a week ago include heavy melting steel, low phosphorus steel scrap, No. 1 railroad wrought scrap, old iron axles, bundled sheet scrap and No. 1 railroad and machinery cast scrap. The other lines in the list with the single exception of stove plate show advances of from 25 to 75 cents per ton.

Buffalo prices for gross tons, f. o. b. Buffalo, are now:

Heavy melting steel	$16.50 to 17.00
No. 1 railroad wrought scrap	16.50 to 17.00
No. 2 R. R. and mch. cast scrap	15.25 to 15.50
Old steel axles	21.50 to 22.00
Old iron axles	22.00 to 22.50
Car wheels	15.25 to 15.75
Railroad malleable	15.25 to 15.75
Machine shop turnings	7.75 to 8.25
Heavy axle turnings	12.00 to 12.50
Clean cast borings	9.25 to 9.75
Old iron rails	17.00 to 17.50
Locomotive grate bars	11.00 to 11.50
Stove plate (net ton)	9.50 to 10.00
Wrought pipe	13.00 to 13.50
Bundled sheet scrap	12.00 to 12.50
No. 1 busheling scrap	13.50 to 14.00
No. 2 scrap	11.00 to 11.50
Bundled tin scrap	13.00

Scrap Market Quieter

Pittsburgh, Dec. 21.—The market for old materials in the Greater Pittsburgh district is not so excited as it was the first two weeks of December. Heavy melting steel, which commanded $18.50 a ton 10 days ago, now is quoted at $17.50 a ton, although some dealers are refusing to consider contracts at less than $18 and $18.50. All other grades of scrap continue to reflect strength. Prevailing prices generally are about 50 cents a ton above those representing the market a week ago. Embargoes against the shipment of scrap to plants at Monessen and Butler, Pa., have been lifted.

Shipments Heavy

Cincinnati, Dec. 21.—Active demand for scrap has fallen away as the holiday season draws near, but shipments continue heavy and the market has lost none of its strength. Prices are unchanged, but indications point to another sharp advance after the first of the year. Despite rumors that heavy melting steel scrap has been selling in surrounding territories at $18 per gross ton, local dealers will quote from $14 to $14.50 on this grade. Shipments are heaviest on bundled sheet scrap, mixed cast, malleable, No. 1 busheling, heavy melting scrap and stove plate.

Chicago Scrap Steady

Chicago, Dec. 21.—Iron and steel scrap is marking time through the final days of the year, prices remaining steady and almost unchanged. Large users are not in the market, apparently having sufficient supply for the present. Much attention is being paid to the price of scrap in the Pittsburgh district, as this has an important bearing on the quotation here. Brokers are picking up more or less material to apply on previous sales, though there has not been much of a short interest in the present market.

Railroad offerings are only fair. The Rock Island offers 4,200 tons, the Soo line 6,100 tons and the Chicago & Eastern Illinois 820 tons.

Strong Demand

St. Louis, Dec. 21.—The demand for scrap continues to be exceptionally strong and railroad lists have brought maximum prices on all grades and tonnages offered. Steel axles are in special demand, and some sales have been noted at $1 a ton over prevailing market prices.

Relaying rails are very scarce and difficult to obtain, and prices on this commodity have advanced from $3 to $5 a gross ton. There are no railroad offerings before the market.

Will Roll Brass.—The Canadian Cartridge Co., of Hamilton, Ont., has secured from the city a site of four acres for the construction of a large addition to its plant. The foundry will be enlarged and equipment installed for the rolling of brass sheets. The company plans to spend $250,000 immediately for equipment and an additional $600,000 before the factory is completed. Extensive war orders have been secured.

(For complete prices see page 1256.)

Billet Demand

Is Greater Than Supply—Prices Are High and Firm

Philadelphia, Dec. 20.—Second quarter billets have been sold the past week by eastern Pennsylvania makers at $55, mill, for forging and at $40, mill, for open hearth rolling steel No trouble has been experienced in obtaining these prices and a considerable tonnage has been booked. A number of the buyers, in fact, have expressed a desire to cover for the last half, but the sellers are not disposed to quote so far ahead at present. The business taken has come from regular domestic consumers of billets, and it has included little, if any, requirement for munition manufacture. The demand for billets continues greater than the sellers can supply, and foreign inquiries receive scant attention except on blooms and billets for shells, which are attractive to some producers because of the high prices possible. Instead of stipulating fixed tonnages, some consumers are inquiring of certain producers for quotations on as much steel as the latter can figure on for a certain period. One large eastern Pennsylvania user in the week asked in this way for an indefinite tonnage of small bessemer billets for first quarter.

Semi-Finished Gains Ground

Pittsburgh, Dec. 21.—Semi-finished steel products, which have been tending upward in price since last July, reflect added strength as the end of the year approaches. Bessemer sheet bars have been sold at $32 and open hearth sheet bars at $33, Pittsburgh, for shipment three or four months hence. While prevailing prices are considered nominal, yet the market has not been tested sufficiently to show any actual change in position. Following the advance of $2 a ton in the price of wire products, wire rods automatically went up to a correspondingly higher level. While no sales have been made recently, it is not believed wire rods are obtainable at less than $42, Pittsburgh. Forging billets are commanding $55, Pittsburgh, and above.

Freight Cars

Still Being Negotiated for by the Pennsylvania Railroad

New York, Dec. 22. (By Wire).—The Great Northern has increased its rail order with the Illinois Steel Co. to 15,000 tons.

New York, Dec. 21.—Negotiations for freight cars still are being carried forward by the Pennsylvania railroad but this system is finding difficulty in arriving at an agreement with the builders as to prices. Some apparently well-founded reports persist that this system has placed recently more cars than it officially has announced. It is believed in some quarters that some lots of box cars have been placed quietly. The New Haven has placed 500 hoppers with the Standard Steel Car Co., the New York, Ontario & Western 350 hopper and 50 ballast cars with the Cambria Steel Co. and 100 hoppers with the American Car & Foundry Co., the Virginian railway 250 steel box cars with the Standard Steel Car Co. and the Lake Terminal railway 30 hopper bodies with the Pressed Steel Car Co. The New York, Philadelphia & Norfolk has closed for 50 box and 10 caboose.

About 5,000 tons of track fastenings have been taken by the Pennsylvania Steel Co. from the French government railways, in addition to the large rail order recently booked, which now, it is officially announced, has been increased to 85,000 tons. The Italian state railways are in the market for 10,000 tons. The Seaboard Air Line has closed for about 4,000 tons with an eastern mill and the Public Service Co. of New Jersey for 1,000 tons of girder rails, with the Lorain Steel Co. The Southern railroad is in the market for 10,000 to 15,000 tons additional.

Wants Bridge Steel

Cleveland, Dec. 22. — The Clover Leaf is in the market for 2,000 tons of bridge material. The Ann Arbor railroad has purchased 1,500 tons of rails.

Will Buy Rails

Toledo, Dec. 22.—Ten thousand tons of steel rails will be purchased by Receiver Walter L. Ross, of the insolvent Toledo, St. Louis & Western Railroad Co., following court permission to expend about $500,000 on needed improvements. The steel is to be purchased at an average cost of $31.50 per ton. Five thousand tons are to be delivered during June, July and August and 5,000 tons during the succeeding three months. Five new locomotives are also to be bought at a price not to exceed $105,000 and a private car will be built at an expense not to exceed $31,000.

Railroads Seeking Cars

Chicago, Dec. 21.—Railroads still besiege car builders for additional equipment, but find it difficult to place their orders, makers being unable to obtain material from mills except after long waits. The Chicago, Great Western railroad is asking bids on 500 box cars. The Central of Vermont is in the market for a considerable number of cars. The Missouri, Kansas & Texas railroad has revived its former inquiry for 2,000 gondolas and 500 general purpose gondolas.

More Embargoes

Have Been Established in the New York District

New York, Dec. 22. (By wire.)—Railroads are making further extensions of both domestic and export freight embargoes in the metropolitan zone. The New York Central embargoes iron and steel products for export at New York and all freight, except food, taking lighterage. The Pennsylvania extends its embargo to include freight except food stuffs originating on its lines to the south as far as Washington and consigned through this district.

Large Lots

Of Squares Bought Owing to Scarcity of Rounds

New York, Dec. 21.—Congestion of the mills rolling large rounds has caused different manufacturers of munitions to enter the market for squares instead and a number of purchases of this product have been made. Some large lots of squares for domestic shell makers are pending including one for 30,000 tons for an eastern Pennsylvania company. The squares have been found especially suitable for the manufacture of shell cases for high explosive shells by the forging process. They also have been used in some instances in making shrapnel cases, the steel being first forged and then machined. Large inquiries for round and square bars and round blooms and billets, continue to come out for last half delivery and most of these are for export.

George H. Graham, secretary and treasurer of the Oriskany Malleable Iron Co., Oriskany, N. Y. died recently. Formal announcement has just been made by the company.

(*For complete prices see page* 1256.)

Metal Markets

Are Quiet, But Prices Firm—Excitement in Tin

New York, Dec. 21.—The metal markets in general have been quiet during the week closing today, but prices have been firm, and in a few cases have advanced. Tin furnished considerable excitement to the trade by reason of the announcement by the British government that it hereafter would curtail exports of tin for the purpose of increasing stocks of the metal in the United Kingdom to 4,000 tons, up to which level the stocks are to be kept until the conclusion of the war. This announcement, it is believed in some quarters, foreshadows a decision in the near future to close the Suez canal to merchant vessels. Under the new policy, which is designed to prevent a shortage of tin in the United Kingdom, the British government is slow to grant permits for exports, but responsible houses report that they have had no trouble so far in making arrangements to make shipments on contracts. The announcement of the new British measure caused sellers here to advance their prices last week and the market has continued firm, on a small amount of business. Quotations are as follows: Spot and December, 39.62½c to 40c; January, 39c; February, 38c; futures, 37.50c.

Copper has been featured by an improved demand the last few days and prices are higher. Electrolytic now cannot be had at less than 20.25c, delivered 30 days. The best brands of lake copper are quoted at 20.50c, cash; ordinary lake at 20.25c, cash, and arsenical lake at 20.12½c, cash. Ordinary casting copper is held at 19.37½c to 19.62½c, cash.

The spelter market, while not characterized by much demand, has reflected an upward tendency in prices. Prime western is quoted as follows: Spot and December, 17.25c to 17.50c, St. Louis; January, 16.50c to 16.75c; February and first quarter, 15.75c to 16c; second quarter, 13.75c to 14c. Brass special is quoted at 19c to 20c, St. Louis, for prompt shipment.

The American Smelting & Refining Co. continues to ask 5.40c, New York, and 5.32½c, St. Louis, on lead. Independent producers quote the same level. Second sellers offer occasionally at concessions. The market is quiet.

The antimony market is exceedingly dull, but prices are firm by reason of the fact that stocks are low. Chinese and Japanese on the spot are quoted at 39c, duty paid. Domestic antimony is offered at 38.75c to 39c, delivered.

Many Important Additions

To Plants of Bethlehem Steel Co.—Some Completed and Others Are Under Way

New York, Dec. 21.—In recent years probably no independent steel company of the country has carried on a more active policy of new construction than the Bethlehem Steel Co. and the enlargements which have been completed or still are in contemplation to its South Bethlehem plant, are both many and comprehensive in scale. During 1915, the Bethlehem Steel Co. has continued this aggressive policy of betterments. Many important extensions to iron and steel producing and finishing capacity then were completed and others now are going forward.

The new work in the Lehigh plant of the company has been the most extensive. In the pig iron department, furnace B has been dismantled and will be rebuilt during 1916 as a modern 500-ton stack with five 22 x 100-foot stoves, making it similar to the other five furnaces of the company. The new furnace will be blown by two single-tandem gas-driven blowing engines of Bethlehem design and manufacture. A new Uhling type of pig casting machine is being installed and will be in operation in 60 days. Blast furnace C, which was rebuilt and remodernized in 1914, was blown in on Aug. 29. In the steel works, six 50-ton open hearth furnaces have been built in the No. 3 plant and two were put in service in December. The other four will be lighted in January. A new 100-ton ladle crane was installed in open hearth No. 1. A 10-ton Girod electric furnace has been completed, but is not yet in service, as the power capacity required has been used, temporarily, for other purposes.

All the new finishing mills of the Lehigh plant, except the 18-inch continuous mill, have been started during the past six months. These include a 35-inch reversing motor-driven blooming mill; a 22-inch, 4-stand merchant mill; a 10 and 12-inch mill; a 12 and 8-inch mill and a 10-inch mill. All these mills are motor-driven. All the bar mills are producing special steel, including various alloy steels. Two new motor-driven mills for the crucible department, a 16 and 12-inch and a 12-inch and 8-inch have been received and will be installed during the coming spring. The reconstruction of the building over the puddling mill furnaces and rolling mill is well advanced. A 2,000-ton forging press has been authorized with its complement of heating furnaces, cranes, etc., and it will be installed the coming spring, contiguous to the present capacity of this character. A new hammer shop with full equipment is being provided for housing the present hammer forge equipment. The latter is being removed to provide room for the new 2,000-ton press. In the treatment department, a 1,500-ton straightening press is being built. An additional building, 52 x 238 feet, is under construction to increase the capacity for the heat treatment of medium-sized forgings.

Extensive additions have been made to all machine and forge shops in which ordnance and its materials are manufactured. Some of these extensions still are in course of construction and of equipping. They include the rebuilding of that portion of the No. 4 machine shop destroyed by fire on Nov. 10. These extensions are expected to be completed early in 1916.

The new electric power house of the Lehigh plant to house three additional 3,000-kilowatt alternating current Bethlehem gas-engine-driven generators, was completed and put into service the middle of the year. A further extension now is partially constructed and will be equipped with four of the same units. A large water cooling pond to filter and cool the water used by all gas engines has been authorized. In the yard, a scrap-breaking plant, located on the cinder dump, is practically completed. This plant will replace three isolated crane runways now in service. Two additional 3-ton locomotive cranes, two broad-gage locomotives and two narrow-gage locomotives have been installed. A new car dumper complete with bins and railroad tracks has been authorized. This will be of the "single" type and will be installed as an auxiliary unit to the two-car dumper now in use.

Plans are completed for a new general office building which will be an addition to the present structure and will be of the same general dimensions and appearance. It will be erected west of the present building. During the year the company built and fully equipped with modern appliances a 1-story building, 150 x 210 feet, for the use of Battery A, field artillery, Pennsylvania militia. This troop is made up of men employed in the various departments of the steel company. The building is of brick and steel construction. It includes a drill hall, gun shed, stable, quarter-master's storage, harness rooms, locker rooms and shower baths. The field equipment of the battery is of the latest United States government standard. The guns, gun carriages, limbers and caissons are of Bethlehem manufacture. A new safety and welfare building is under way to be completed early in the spring. It will be thoroughly equipped to carry on the various phases of first aid work.

In the Saucon plant, a large new steel works extension is under way. This will consist of eight 125-ton open hearth furnaces. There also is under construction a three-high, 18-inch mill and a two-high 12-inch modified continuous mill with 10 stands of rolls for the production of beams, channels and angles. Both mills are motor-driven and have a full equipment of heating furnaces, shears, cooling beds and transfer tables. This new finishing capacity will be completed during the coming year. A fully-equipped extension to the bridge shop, 90 x 400 feet, for the fabrication of medium and light weight structures, has been completed. A new repair machine shop, roll shop and electrical repair shop, thoroughly equipped, has been completed and is in operation. The former shops of this character were removed to make room for the new beam mill. Waste heat boilers have been installed at all the present 16 open hearth furnaces, as well as over the two continous heating furnaces for the 28-inch structural mill. A new general office building and first aid station with new entrance gates, etc., have been completed.

The Bethlehem Steel Co. has made arrangements for the erection of unloading machinery to handle its Cuban and Chilean ore on the new pier, 1,160 feet long and 84 feet wide, which the Lehigh Valley railroad is building at Constable Hook, N. J. There will be installed on the pier two unloading machines, one of which will be of the Hulett "walking beam" type, with a bucket capacity of 17 tons, to be furnished by the Wellman-Seaver-Morgan Co., Cleveland, and the other will be a lighter "crane" type machine with a bucket capacity of five tons, for the smaller sea-going vessels, which is being built by the Meade-Morrison Mfg. Co., Boston. The combined capacity of these machines is 1,000 to 1,400 tons per hour. A channel has been provided, giving a water depth of 35 feet to the pier at mean low tide, enabling large sea-going vessels to be docked. The pier will be ready for operation early in 1916.

He Tells How It's Done

Chairman Davies Describes Methods of Federal Trade Commission in Correcting Abuses

Hon. Joseph E. Davies, chairman of the federal trade commission, in an address before the American Manufacturers' Export Association in New York, Dec. 21, told of efforts to correct abuses made by the board. He said in part:

"The federal trade commission was created out of a desire to bring into the relations between government and business and society, a constructive agency. It was designed by those who created it not as a punitive, but as a corrective force. It was hoped that it would serve to bring about a more simple, direct and informal agency for adjustment of matters than would be afforded through a strictly judicial or a strictly administrative agency. The fact that there may be comparatively few complaints brought by this body is therefore not an indication that relief is not being accorded; but may be in fact an indication that the effectiveness of this agency is being demonstrated along the lines contemplated by those who sought its enactment. A few illustrations of the manner in which this operates will illustrate the situation.

A corporation engaged in the business of selling typewriters circulated among dealers in many cities a letter falsely stating that a competitor had moved its factory from Chicago, and that the customers of such factory would be compelled to make new arrangements for obtaining typewriters, which need the advertising corporation was prepared to fill. A letter directed to the corporation complained of resulted in a retraction, and in the circulation of such retraction extensively, and the applicant for a complaint thereupon requested the dismissal of the matter.

"In still another case, a corporation engaged in the manufacture of an article, published advertisements in which were statements disparaging the goods of a competitor in an improper way. The practice was called to the attention of the commission, with the result that it was immediately discontinued.

"Recently complaint was made by one of the large so-called independents against an alleged price-discrimination practice indulged in by a larger competitive rival. Upon complaint being made by the commission with the larger competitor, the assurance was voluntarily given that the practice would be discontinued, not only as to the party complaining, but also as a general practice, and as to all persons in the trade. Thus it happens that the relief which the commission could give, to wit, the procurement of the stopping of the practice, is secured with immediate relief to those injured, instead of going through a long process of litigation and procedure that might involve months, or possibly years, for its final determination.

"It is contemplated that by the publication of a ruling upon each case, as it is disposed of, that ultimately a body of cases will be built up which will operate as a code of what establishes fairness and unfairness in trade, to the benefit of industry in this situation where formal complaint do not come to trial.

"The powers of the federal trade commission are limited by the law of its creation. They are not as extensive as many proponents might have desired; but its responsibilities are greater than its power. To the extent that in its power lay, it is bent and animated by a desire and purpose to aid in every possible manner that is consistent with democratic institutions, in the development of the power and greatness of this nation as an industrial, commercial and financial nation in the world.

"It is one of the agencies of government that must seek, in small part, to aid in the solution of the great problem of the future."

Will Double Output

The Farrell-Cheek Steel Foundry Co., Sandusky, O., has placed contracts for the buildings and most of the equipment necessary to double their present output, giving them a capacity of 800 tons per month. The company also has purchased a tract of land adjoining its present factory site for further extensions, the plans for which are now being prepared.

Metallographist Wanted.—The United States civil service commission announces an open competitive examination, Jan. 25, for metallographist, for men only. From the register of eligibles resulting from this examination certification will be made to fill a vacancy in this position in the war department, for duty at Watertown arsenal, Massachusetts, at a salary of $2,000 a year. The commission also announces an open examination for structural engineer and draftsman, for men only, on Jan. 19 and 20, 1916. From the register of eligibles resulting from this examination certification will be made to fill a vacancy in this position in the office of the supervising architect, treasury department, Washington, at $1,800 per annum.

With an "If"

Announcement is Made by the University of Illinois

What is said to be an entirely new method of producing pure iron, which, it is believed, will save the electrical industries of the country a large amount of money annually, has been discovered by Dr. Trygve Yensen, an assistant in the engineering experiment station of the University of Illinois, it was announced at the university last Saturday.

Dr. Yensen's discovery was made during his investigation of magnetic properties of iron and iron alloys. He is a graduate of the university's college of engineering, in the class of 1907, and has been connected with the experiment station since 1910.

The university declined to permit a patent of the process to be taken out, believing the benefits should accrue to everyone. An announcement made at the university was as follows :

"The method used by Dr. Yensen consists of melting electrolytically refined iron in a vacuum, thus reducing the impurities far below any point which had been reached by previous investigators. The magnetic property of this vacuum-fused iron has proved to be as remarkable as its purity. Its maximum permeability, *i. e.*, measure of ease with which it can be magnetized was found to be two or three times higher than for the best magnetic iron or iron alloy previously reduced.

"A practical result of this investigation is that if it should turn out to be commercially profitable the amount of material needed for electrical machinery such as transformers would be cut in two and the losses which occur continuously as long as the machine is in operation would be greatly minimized. The annual saving to the electrical industries of the country by application of this discovery will amount to between $15,000,000 and $20,000,000 if it should turn out that the iron can be produced at the same expense as the iron at present used."

The Wine Railway Material Co. is completing a new factory building on Broadway near the Wabash railway crossing, Toledo, O.

Armour Mines on Cuyuna Range

Some Interesting Features of Development in the New District of Lake Superior Region

THE sudden renewal of mining operations about the first of August at the Pennington mine in the Cuyuna district recalls the prominence this mine at once gained when it was opened in the fall of 1912, being the first open pit operation in the district and because of the snap with which all work at this mine was then and has ever since been carried on.

The Pennington mine embraces the SW¼-NE¼ and NW¼-SE¼ of section 10, 46-29, Crow Wing county, Minnesota. The fee is owned by a number of individuals and several holding companies and is a part of a large tract owned by them. The property was described in a recent issue of *The Iron Trade Review*. The mine is named after Edward Pennington, the president of the Minneapolis, St. Paul & Sault Ste. Marie Railway Co., and the ore is shipped over that line.

The Armour No. 1 Mine

The Armour No. 1 embraces the SE¼-NE¼ of Section 10 and adjoins the Pennington on the east. The fee is owned by John Mattson, a farmer, being part of his homestead property, and was leased by him to the C. M. Hill Lumber Co., which explored the property and then sub-leased to the Iroquois Iron Co. The property was opened by the latter, which sank a concrete shaft and shipped 155,000 tons up to July, 1913, when all operations ceased. In January, 1915, the Iroquois company assigned its lease to the Inland Steel Co. William Wearne is in charge of the Inland Steel Co. operations. The shaft is still idle but this year the westerly half of the property was converted into a pit and here mining is now in progress. This pit is approximately 600 feet in diameter. Both the Pennington and the Armour being idle last year, together with their relative locations, made it possible to strip this part of the Armour, especially in the manner pursued. Part of the Armour No. 1 stripping was dumped in naturally low ground and in caved ground on the Armour No. 2 property to the east and part was moved westward through the Pennington pit to another place. This stripping work was contracted to the Pennington Mining Co., whose equipment happened to be on the ground, and as all the conditions were most favorable, about 800,000 yards were moved in a short time, producing an average of 154,000 yards per month per shovel, a record probably never before attained. The ore in the Armour pit will be mined this year by the Pennington company and will be moved through the Pennington pit.

The Ores

The ores in these two mines form one large deposit and are, therefore, identical in character. They represent some of the best non-bessemer ores in the district. At the northeast end of the Armour property, there is some manganiferous material, but the Pennington, so far as known, has none. The formation is probably about 200 feet wide at its maximum, is folded quite a little but does not deviate from a uniform strike, which is a little north of east, and a southward dip. The ore body follows the troughs formed by the folding of the surrounding iron-bearing formation and pitches variously and is broken, due to slumping. The ores are coarsely granular and their color varies from brown to red, but is prevailingly the latter.

Experience has shown that the first ores shipped from any of the mines in the district run higher in moisture than those following. The first year's shipment from the Pennington ran 12.80 per cent in moisture. The iron content was a little over 59 per cent dried making, therefore, a base ore. The intention of this operator is to maintain the 51.5 per cent grade. The silica in this ore runs about 7 per cent, alumina about 2.5 per cent and loss on ignition about 3 per cent. The Armour ore shipped in 1913 was a trifle lower in iron, but so also was the moisture content, producing in the end the same natural metallic iron content. The physical structure, the furnace men say, is excellent.

Mining Methods

Neither property was ever drilled so as to demonstrate the total tonnage, but what drilling was done was carried out rather systematically. Only a small proportion of the known tonnage can be removed by steam shovel, a larger proportion by the milling method and ultimately underground mining will have to be resorted to to complete the mining. Part of the ore is already known to extend to a depth of 400 feet, and the indications are that it extends to a much greater depth. The Armour property already has a shaft with a steel headframe and good surface equipment, but for future underground operations at the Pennington a shaft will have to be sunk on this property. Either property could ship about 300,000 tons or more a year.

The royalty paid by the Pennington company is 80 cents per ton for pit ore and 75 cents per ton for ore mined by underground methods. The royalty paid by the Inland Steel Co. for the Armour ore is a sliding royalty based on a 60-cent price for a 50 per cent natural iron content and being higher or lower according to a fixed schedule as the iron content increases or decreases, a base ore costing about 64 cents per ton.

The Armour No. 2 Mine

The Armour No. 2 property is in many respects without question one of the best in the Cuyuna district. The property comprises the S½-NW¼ of Section 11, 46-29, Crow Wing county, Minn. The mineral rights are owned by one of the companies of the recently deceased Fred Weyerhaeuser, the wealthy and widely-known lumberman, but the surface rights were acquired by others and the Crow Wing Land Co. was formed to handle them together, which leased to the Iroquois Iron Co., costing it 50 cents per ton. While the Iroquois company had the lease, the mining was done by the Rogers-Brown Ore Co., but in January, 1915, the latter assigned its lease and interest to the Inland Steel Co., which continued mining without cessation. The operations of the Inland Steel Co. are superintended by William Wearne. It is understood that the Iroquois company will use 75,000 tons of this year's output.

The very first drilling by the Iroquois company showed some exceptionally good ore, but much secrecy was maintained about the results, the explorations were cut short, immediately a concrete shaft was sunk and excellent surface equipment installed. The surface is 63 feet deep and quick sinking was accomplished. The shaft is about 200 feet deep. The main level

was driven at 160 feet, the mine was opened rapidly, and ore shipped immediately. When the ore was first seen above ground it occasioned great surprise, for it showed a purple cast and a semi-metallic luster, some sparkling quite brilliantly in the sunlight, an ore never before seen in the district up to that time nor suspected to be present. It is even now the most attractive looking ore shipped from the district.

Rarely is a property ever opened for operations with so little preliminary exploratory work as this one received. Later a little more drilling was engaged in and the tonnage was increased considerably, but the property is still only partially explored. The Minnesota tax commission credits this property with over 7,000,000 tons averaging 57.6 per cent in iron. It would take much drilling to properly or fully explore it because the deposit is rather irregular in shape.

Good Demand

For Ferro-Manganese Hard to Fill—Prices Are Higher

New York, Dec. 21.—A good demand for spot ferro-manganese has developed, and there is difficulty in satisfying it, owing to the limited tonnage that is available for sale. A Youngstown steelmaker asked for 1,000 tons of spot, but has been obliged to accept future deliveries. Odd tonnages of unsold English metal which are in hand are being quoted by sellers at $110, seaboard, but no transactions at this figure are reported. The maximum amounts of such metal open to purchase do not exceed a few hundred tons. English makers continue to take a considerable tonnage for shipment up to July 1 at $100, seaboard. There is a good inquiry for that shipment and sales are aggregating several thousand tons weekly. Domestic producers still hold for a minimum of $110, furnace, for sizeable quantities, but on carloads or 100 tons are asking up to $1.20, furnace. Ground ferro-manganese shows the considerable range of about 5 to 7 cents per pound at the grinding plant.

New shipments from England remain light, but a considerable tonnage is afloat. The ROWANMORE arrived the past week with but a few hundred tons. Some English agents now are arranging for licenses for January shipment from the other side. November arrivals are estimated at about 4,500 tons.

The manganese ore market continues on a high plane, due, in a large measure, to the abnormal freight rates. From India to Philadelphia, a rate of 80c has been quoted.

Bridge Work

In Large Tonnages to be Placed During Winter and Spring

New York, Dec. 21.—Advance information has reached leading fabricators that eastern railroad systems are preparing to place some larger tonnages of bridge work during the winter and next spring. Among the systems which are understood to have important programs in view are the Pennsylvania, Baltimore & Ohio and other lines. These prospects for bridge work increase the more favorable character of the outlook for fabricated steel tonnage in the east for later months. At the present time, the new tonnage is running in a contracted way, as usually is expected for this season but some shops declare it is ahead of normal.

About 30,000 tons of additional subway and elevated work was closed formally with the American Bridge Co. the past week. The British government has inquired for 1,000 tons of plain material. It is understood that as high as 1.85c, mill, has been offered by foreign buyers for plain beams. Plain material prices in this market still show a considerable spread, in accordance with the mill, tonnage and delivery. Sizeable tonnages have been placed with eastern mills at 2c, Pittsburgh, or 2.169c, New York, for shipment in one to three months. All going prices are included within the range of 1.919c to 2.159c, New York.

Very High Price

Philadelphia, Dec. 20.—A sale of 2,000 tons of basic iron for second quarter shipment has been made to an eastern buyer by an eastern Pennsylvania maker at $22, furnace. The iron will run 0.15 in phosphorus. This is the highest price that yet has been developed, either on standard or on special basic in the eastern market.

J. W. Sheperdson has resigned as assistant general superintendent of the Central Iron & Steel Co., Harrisburg, Pa., and will become connected with the Morgan Construction Co., Worcester, Mass., in the early part of January.

The National Malleable Castings Co. is operating its Toledo factory full time, full capacity, and is said to be far behind with its orders.

Merger Talk

Includes Gossip About What Might Have Been Done

Youngstown, O., Dec. 21.—The aspect of the Youngstown Sheet & Tube-Cambria-Lackawanna merger negotiations has not altered perceptibly since the meeting of the Sheet & Tube stockholders a week ago. The Inland Steel Co., Chicago, has figured in the affair only directly or indirectly for less than a week, despite the prominence given it in this connection by the daily press several weeks ago. That the negotiations will be concluded successfully is by no means assured. One well-informed iron and steel man remarks:

"The syndicate got busy about six months too late. Now business is abnormally good and profits are rolling in, where before it was almost stagnant. Hence stockholders hesitate to accept a figure offered for their property which is almost twice what they would have been willing to take six months ago. I believe this is true of Lackawanna."

Some Lackawanna Steel enthusiasts claim the company will show net profits of $15,000,000 in 1916, or more than 40 per cent on the outstanding capital stock of $34,756,000. It is understood that such interests are holding out for $90 a share, as against $80 to $85, reported to have been offered by the syndicate. On the other hand, it is argued that the present unusual steel demand is no criterion of values, and that in view of Lackawanna's bonded indebtedness and its low earnings previously—averaging 2.6 per cent the past 10 years—the price offered not only represents the actual value of the property as it now stands, but includes also the increases in value to be effected, provided the companies are merged.

Considerable trading has been done in Youngstown Sheet & Tube "rights". Sales have been made both at Cleveland and Youngstown at $14 and $15 a share, and some at higher than $20 are reported.

Plates for Water Line

New York, Dec. 21.—Eastern plate makers are interested in the requirement of about 15,000 tons for a riveted 72-inch water line from Boonton, N. J. to Jersey City, bids for which have been deferred and now are to be taken on Dec. 24. Shipyards in the metropolitan district have been scouring the market attempting to obtain 15,000 to 20,000 tons of plates and shapes for vessels which it has in view, but thus far have been unsuccessful.

How to Utilize Waste Heat Boilers

THOUGH the use of waste heat boilers in conjunction with regenerative furnaces is a comparatively recent innovation, excellent results have been attained. Boilers now in use are showing a saving equivalent to 250 pounds or more of coal per ton of ingots. The practice itself is capable of much further study; and many improvements are being made. Mr. Bacon cites numerous problems of present installations.

By C. J. Bacon

THE EMPLOYMENT of boilers for utilizing waste heat from open hearth and other regenerative furnaces, directs attention to a region where steel makers may find attractive opportunity for increased economy. While waste-heat boilers in various forms have long been used with heating, puddling and other non-regenerative furnaces, only during the last four or five years has the practicability of their use with regenerative furnaces been conclusively demonstrated.

The introduction of a boiler in the path of hot gases is not in itself novel, and no mysticism has been unfolded in recent investigations. What has been accomplished, however, is the practical proof of usefulness of boilers with low temperature gases and a determination of the conditions of open hearth practice that limit the constructive and operative features. Necessarily, a study has been made of the rate of heat transmission existing in commercial types of boilers. The tardiness in the development of boilers for recovering the enormous quantities of waste heat from regenerative furnaces is an indication of the difficulties and uncertainties in the path of this form of improvement, whereas the use of boilers with non-regenerative furnaces has long been common practice. Existing boilers on large open hearth furnaces are showing a saving which, when expressed in terms of fuel required in coal-fired boilers, is equivalent to at least 250 pounds of coal (11,000 B. T. U. per pound) per ton of ingots. The open hearth steel produced in 1913 in the United States amounted to approximately 27,000,000 gross tons. As the majority of the furnaces are over 50 tons capacity, it may be stated conservatively that the use of boilers would result in saving between 150 and 200 pounds of a medium grade of coal per ton on this total production of ingots. The annual saving would thus be at least 2,000,000 tons of coal, an ample inducement for widespread adoption of this form of improvement.

Recent activity in this direction at several steel plants is seen to be fully justified when it is recalled that 45 per cent of the total heat delivered to the open hearth as fuel gas and combustible elements of the charge is wasted to the stack, and that one-half or two-thirds of this loss may be recovered by boilers at 60 per cent or greater return on the investment. The heat thus saved is in the form of steam, and it is customary to express this saving in terms of the coal required in a boiler house for generating the same amount of steam.

While the use of boilers in such applications as soaking pits and heating furnaces of regenerative type has not received a proportionate share of attention, yet the waste gas conditions are, or may be made, as promising for the generation of steam as in open hearths. Generally speaking, a suitable boiler on any type of regenerative furnace will prove a paying investment, provided precaution be taken to minimize the wasteful and unnecessary cooling of the gas through infiltration of air and dissipation of heat. This paper describes briefly some of the representative open hearth boilers, and points out such results and operating experiences as may be indicative of savings elsewhere and helpful in future installations. Fifty or more years ago, the waste gases on the way to the stack from puddling and heating furnaces of various kinds were passed under crude boilers, consisting of single drums or shells, 5 feet in diameter and 40 or more feet long, without flues or tubes. Although giving indifferent results, this practice marked the beginning of a train

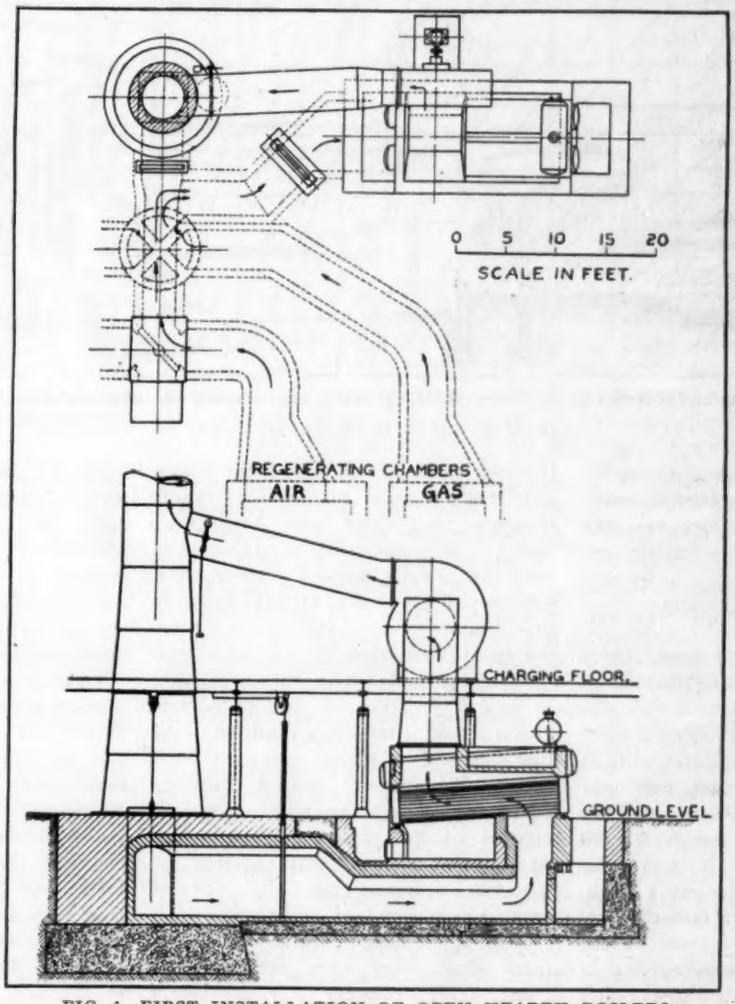


FIG. 1—FIRST INSTALLATION OF OPEN HEARTH BOILERS

Presented at the last New York meeting of the American Iron & Steel Institute. The author, C. J. Bacon, is steam engineer, Illinois Steel Co., South Chicago, Ill.

of improvements which led to the adoption of highly developed water-tube boilers for the reverberatory type of furnace. With regenerative furnaces, however, but little progress was made, and this was due to the low cost of fuel and relatively great investment required for recovering the reduced quantity of heat from the low temperature gases. Moreover, the limitations of open hearth practice demanded a treatment, the difficulties of which seemed greatly out of proportion to the prior simple installations with reverberatory furnaces.

Of first consideration in the use of boilers with an open hearth are the requirements that the draft necessary for operating the furnace be not impaired, that the boiler equipment be made to fit the limited space available and that ample surface and gas passages be provided to handle the gases efficiently.

Existing Boilers on Open Hearths

The first installation of open hearth boilers was made in 1910 on a 65-ton furnace at the South Chicago works of the Illinois Steel Co. Preliminary tests and calculations indicated that at least 60,000 pounds of gas per hour at a temperature of 1,200 degrees Fahr. was escaping up the stack, and from these conditions it was estimated that the probable gross available output would be 175 boiler horsepower. As little was known of the requirements for this new service, a second-hand Heine water-tube boiler of the usual horizontal type, having 1,900 square feet of effective heating surface, was installed. This was done with the expectation that even if it should not prove entirely satisfactory for the purpose, at least it would provide a convenient means of making a study of the peculiar conditions.

The installation was made essentially as shown in Fig. 1. The entire equipment, particularly as to auxiliaries and attachments, was made as simple as possible at the outset in order to facilitate the numerous changes and adjustments required in adapting it to the unknown conditions. The demand of the open hearth furnaces for a draft of one and one-half inches, or more, in the stack flue made it imperative that a fan be used between the boiler and stack to restore the loss of draft caused by the lower gas temperature and the friction through the boiler and connecting flues. The gases made a single pass over the heating surface, entering the bottom of the bank of 113 3½-inch tubes near one end, and passing from the top of the bank at the other end.

After the boiler was put in service, in February, 1910, and desired adjustments made, a test of a month's duration showed a gross output of 190 boiler horsepower during furnace heats, with gas at an initial temperature of 1,150 degrees. Approximately 30 boiler horsepower was required for the engine-driven fan, the exhaust from which was not recovered.

Although these results were far from ideal, they were indicative of considerable economy in a previously little explored region of open-hearth practice. Moreover, they demonstrated not only the practicability of application to open hearth furnaces, without detracting from the tonnage or quality of steel, but indicated to what degree still greater steaming capacity could be realized by using larger boilers. In fact, it was evident that boilers with twice this amount of surface would be none too large for furnaces making 72-ton heats, consequently the following year two more boilers of larger size were installed in the same open hearth plant, as shown in Fig. 2.

Second Installation

A special type of Stirling water-tube boiler was selected, having 4,000 square feet of evaporating surface, but requiring relatively low head room, thereby permitting location entirely under the charging floor. They were provided with superheaters, special baffling, induced-draft fans, economizers, permanent soot-blowers and other special features to favor not only the more extensive absorption of heat, but to provide facilities for more efficient operation and maintenance. Each boiler was divided into three passes, and was composed of 30 sections of tubes with each section having 13 3¼-inch tubes. At the rear of the boiler setting, between the damper and fan, there was an economizer or feed-water heater made up of cast iron radiator sections, but it was soon removed, as it did not operate satisfactorily, due to excessive obstruction to the flow of gases and troublesome accumulation of dust on the irregular

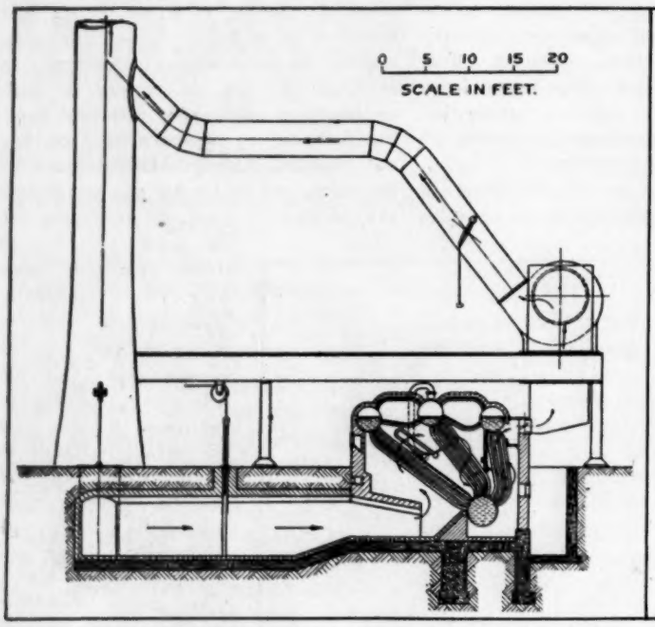


FIG. 2—SECOND INSTALLATION WITH LARGER BOILERS

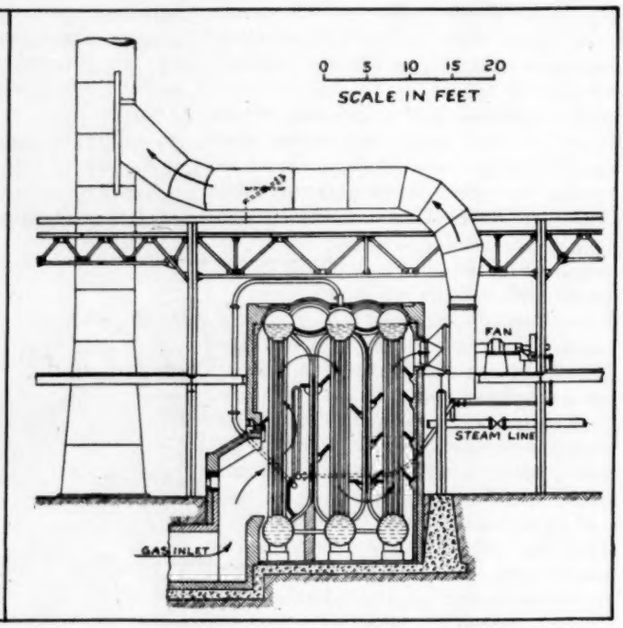


FIG. 3—THIRD INSTALLATION SHOWING SPECIAL TYPE OF BOILERS

surface of the sections. The fans have 72-inch wheels, especially constructed to suit the volume and temperature conditions, and are driven by electric motors at a speed of 400 revolutions per minute, providing a total draft of 4 inches of water, nearly one-half of which is required to restore the amount of draft previously furnished to the open hearth furnaces by the stack.

Tests on Second Installation

A series of 77 tests, each of the duration of an open hearth heat, was made on these Stirling boilers with varying temperatures and quantities of waste gases. The following average results of 10 tests with normal gas conditions were obtained:

Total duration of 10 tests, 78.5 hours.

Output of boiler and superheater, 334.5 boiler horsepower.

Feed-water temperature, 60 degrees Fahr.

Steam pressure, 123.3 pounds gage.

Superheat, 128.2 degrees Fahr.

Inlet gas temperature, 1,227.0 degrees Fahr.

Outlet gas temperature, 621.0 degrees Fahr.

Weight of gases entering boiler, 73,000 pounds per hour.

Heat absorbed by boiler per hour, 11,200,000 B. T. U.

Heat absorbed by boiler per ton ingots, 1,575,000 B. T. U.

Draft loss through boiler, 1.78 inches water.

Rate of heat transfer, 5.08 B. T. U. per hour per square foot heating surface, per degree mean temperature difference between gas and steam.

It will be seen that an average of 335 boiler horsepower was obtained during heats when all the gas from the furnaces, or 73,000 pounds per hour, was passing through the boiler, and that the temperature was reduced from 1,227 degrees at the inlet to 621 degrees at the outlet.

Those two Stirling boilers, as well as the previously installed Heine boiler, have been in almost uninterrupted service since their installation, and recording instruments show an average output over long periods of time of about 280 boiler horsepower for each boiler, in addition to 25 horsepower due to the effect of heating the feed-water on the gas valves.

Following the investigations at South Chicago, 28 boilers were installed at another plant where the furnaces are of 85 tons rated capacity. As there was not sufficient room under the charging floor, Rust vertical boilers, each having 4,880 square feet of heating surface, were installed, as shown in Fig. 3.

This special type of boiler has six drums, three above and three below, 209 4-inch vertical tubes, and the setting occupies a space 11 x 21 feet, 31 feet high. It has three passes for the gas and liberal cross baffling to distribute the gases well over the heating surface. During the preliminary tests there was occasion to make several changes in the baffling in an effort to determine the most economical balance between heat absorption and draft loss, the final arrangement being shown in the drawing. Superheaters having 346 square feet of surface were located behind the bank of tubes in the first pass, where they were protected from the high temperature gases.

Tests on Third Installation

In this installation the fans, which have 90-inch diameter wheels, of special proportions to suit the high draft and temperature conditions, are driven by steam turbines, the exhaust of which is utilized in a central feed heating system, so that the net cost of fan operation is very low, being only seven boiler horsepower, or less than 2 per cent of the gross output of the boiler. After various changes the following continuous test was made, representing average conditions during heats:

Duration, 152.2 hours.

Output of boiler and superheater, 393 boiler horsepower.

Steam consumed by fan turbine, 60 boiler horsepower.

Steam returned to feed-water heaters, 53 boiler horsepower.

Net output of boiler, 386 boiler horsepower.

Steam pressure, 126.1 pound gage.

Temperature of superheated steam 530.8 degrees Fahr.

Inlet gas temperature, 1,155 degrees Fahr.

Outlet gas temperature, 530 degrees Fahr.

Weight of gases entering boiler,

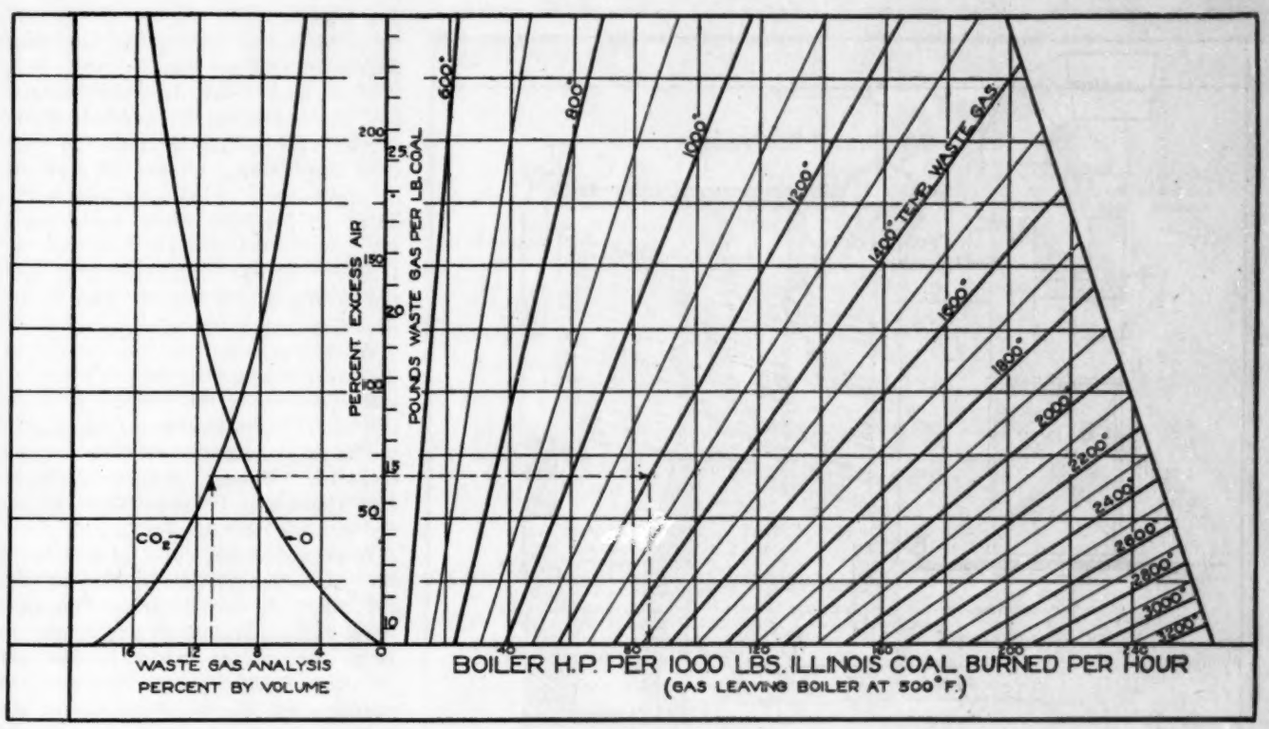


FIG. 4—BOILER HORSEPOWER AVAILABLE FROM WASTE GASES

83,434 pounds per hour.

Heat absorbed by boiler per hour, 13,200,000 B. T. U.

Heat absorbed by boiler per ton ingots, 1,840,000 B. T. U.

Draft loss through boiler, 2.48 inches water.

Rate of heat transfer, 6.92 B. T. U.

While these test results show that the average evaporation is 393 boiler horsepower during heats, 350 horsepower may be safely counted on for a year's average. The effect on open hearth practice, as a rule, has been to materially reduce the time per heat.

Another installation of a single boiler is shown in Fig. 5. This boiler deserves particular reference on account of the very high evaporation from a relatively small furnace of 30 tons rated capacity. It was found advantageous to locate the boilers entirely outside the open hearth building, whereas in all installations elsewhere the boilers had been put under the open hearth building between the stacks, where the construction cost was necessarily considerably higher, due to obstructions and alterations. So encouraging has been the performance of this boiler that steps are being taken to equip the remaining furnaces of the plant in a similar manner. The boiler is the Babcock & Wilcox cross-drum type, having 2,605 square feet of heating surface in 162 4-inch tubes, divided into three vertical passes so that the gases pass transversely across the approximately horizontal tubes, a condition favorable to a high rate of heat transmission. The following test of 120 hours' duration is representative of average conditions while making steel:

Output of boiler, 202.2 boiler horsepower.

Steam pressure, 115.4 pounds gage.

Feed temperature, 49.6 degrees Fahr.

Inlet gas temperature, 1,153.0 degrees Fahr.

Outlet gas temperature, 479.0 degrees Fahr.

Weight of gases to boiler, 41,470 pounds per hour.

Heat absorbed by boiler per hour, 6,700,000 B. T. U.

Heat absorbed by boiler per ton ingots, 2,220,000 B. T. U.

Draft loss through boiler, 1.92 inches water.

Rate of heat transfer, 6.86 B. T. U.

Although this test shows 200 boiler horsepower, a fair estimate of the average output over long periods is 170 to 175 horsepower without deducting the steam required for driving the fan engine, which in this instance is a considerable amount, since there is no means of recovering the heat in the exhaust. In this case, as in others, there was an apparent reduction in the time required per heat. In addition to the boilers above described, several other installations have been made in various large plants.

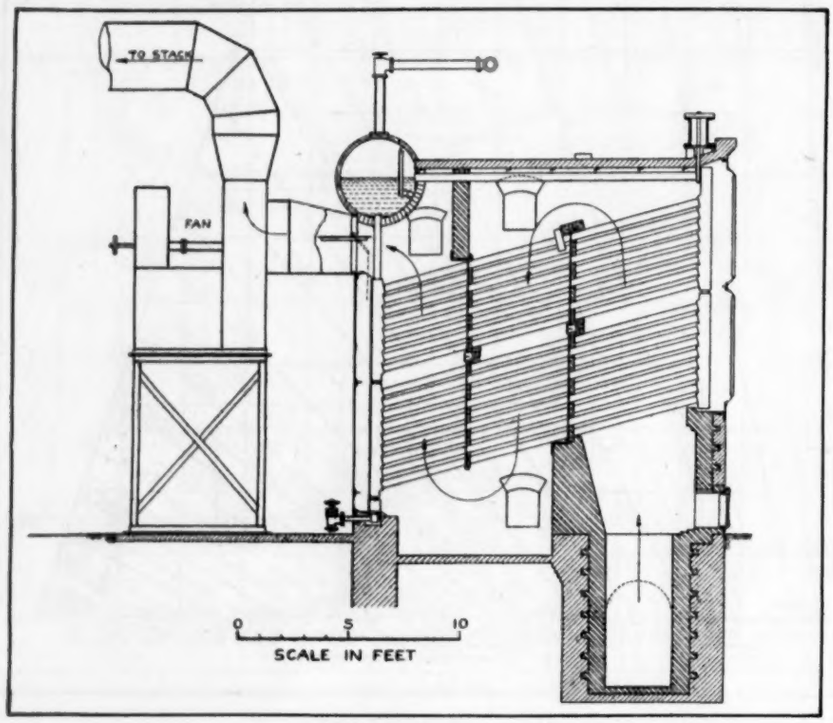


FIG. 5—SINGLE BOILER INSTALLED WITH SMALL FURNACE

With this brief account of progress in some of the representative installations, it is opportune to draw some conclusions from the economical performance of present boilers, to outline the possibilities, discuss the operating difficulties, and direct attention to the avenues leading to further progress in design and operation.

Experience with existing boilers has shown that the heat recovered is about 22 per cent of the heat in the coal charged to the producers, or about 1,600,000 to 2,200,000 B. T. U. per ton of ingots. In terms of coal containing about 11,000 B. T. U., this is equivalent to an average of 180 pounds per ton of ingots. It must be remembered, however, that this heat is in the form of steam which, if generated in coal-fired boilers at 60 to 70 per cent efficiency, would require 250 to 300 pounds of coal. Other approximate statements of the saving are: 1,600 to 2,000 pounds steam per ton of ingots; 65 to 90 boiler horsepower per 1,000 tons of ingots per month; 65 to 90 boiler horsepower per 1,000 pounds of coal per hour.

If the open hearth fuel were natural gas, the boilers would generate about 85 per cent as much steam as with coal, due to less weight of products of combustion. Pittsburgh coal gives about 25 per cent more waste gases per pound than Illinois coal, but on account of less coal consumed per ton of ingots only slightly more steam would be generated.

While the results of tests given in the preceding description of boiler installations show the output in terms of "boiler horsepower during heats", the average output over long periods, including average delays, Sundays, etc., appears to be from 80 to 85 per cent of the test results.

In regard to the effect of boilers on the production of steel, it may be said that when the furnace is new the time required per heat does not appear to be affected to any marked extent, but as the furnace becomes old and the checkers fill up, the influence of the boilers becomes more evident, due to better and more uniform draft from the fans that draw the gases through the boilers.

Operating Difficulties

Air leakage through the brick settings of water-tube boilers is the source of appreciable loss in efficiency, and the most attentive efforts to keeping the settings tight by pointing the brickwork and application of various paints and cements have not been entirely successful. Reports from all the existing installations speak emphatically on this point, and although in some instances excessive leakage has been temporarily overcome, nevertheless the liability of explosions in the flues, boilers and flues leading thereto, demand constant attention, since the explosions loosen the brickwork of the boiler settings, not only

increasing the air leakage, but incurring a high expense for repairs. These explosions are characteristic of open hearth operation, being due to the escape of producer gas into the flues during the reversal of the gas valves, but may be somewhat reduced by close attention to manner of reversing.

The dust coming from the open hearth furnaces and checker chambers is in an exceedingly fine and adherent condition and packs closely onto the boiler tubes, as well as on baffles and projections. There appears to be no means of preventing the dust entering the boilers, consequently the only remedy so far applied is frequent blowing with steam by portable and permanent soot-blowers. As a rule, blowing at intervals of six hours has been found sufficient, if the operation be thoroughly performed, but after the dust has been allowed to remain it has a tendency to form a scale which is more difficult to dislodge than the freshly deposited dust. In addition to blowing the tube surface while the boilers are operating, the practice is to give them as thorough a sweeping as possible when out of service.

Cost of Installation

The cost of installation is about 25 per cent higher than for ordinary coal-fired boilers, in spite of the elimination of coal and ash handling equipment, stokers, etc., and this is due to the abnormal expense of construction work performed on isolated waste-heat units in cramped quarters, changes to buildings, underground flues and foundations, and to the necessity of applying large steam or motor-driven fans. Some waste-heat boiler installations are being built during the construction of open hearth plants, and therefore should show a considerably less cost.

Weight of Waste Gas to Boiler

The weight of gases from open hearth and other furnaces is very difficult to determine. Accurate direct measurement is out of the question, due to lack of suitable conditions for use of meters. The weights mentioned above in the test results were calculated on the basis that total heat absorbed in the boilers requires a certain amount of gas to be cooled between the initial and final temperatures. Radiation from the setting is small and not considered. This method is subject to serious error, due to uncertainty as to the specific heat of gases at these temperatures, and more particularly to the difficulty of obtaining representative temperature readings and gas analyses used in determining the amount of air leakage. Determining the weight of gas from the combustion of the fuel and elements in the charge would be a better method if the rate of fuel consumption during tests were accurately known, but this method also is affected by the accuracy of gas sampling. On account of this uncertainty, ample allowances should be made in the design of boilers, flues and fans. Air leakage has a serious effect on boiler output and fan work and should be eliminated by air-tight steel casings around the boiler settings when the water-tube boilers are used. Fig. 4, giving the boiler horsepower available from waste gases, may be found useful in making quick determinations of amount of heat recoverable as steam. Although intended for Illinois lump coal, the diagram may be used for Pittsburgh run-of-mine by adding 25 per cent to the results. If the open hearth charge is about 65 per cent pig iron, a further increase of 17 per cent should be allowed for the additional gases formed by combustion of elements in the charge. Fig. 6 correlates many of the factors upon which the design of waste-heat boilers depends.

HEAT BALANCE OF OPEN HEARTH FURNACE

	B. T. U. per hour.	B. T.U. per ton ingots.	Per cent of heat in coal.	Per cent of heat in fuel gas.	Per cent of heat to furnace.
Coal to gas producers.....	52,500,000	7,000,000	100.0	.....	.....
Producer loss	8,620,000	1,150,000	16.4	.....	.....
Heat Delivered to Furnace					
Gas from producers	43,890,000	5,850,000	83.6	100.0	.....
Combustion of C, Si and Mn in charge	9,370,000	1,250,000	17.8	21.4	.....
Sensible heat of hot metal...	3,450,000	460,000	6.6	7.9	.....
Total heat to furnace except regenerating gas and air....	56,710,000	7,560,000	108.0	129.3	100.0
Distribution of Heat.					
Consumed in furnace and losses	31,450,000	4,192,000	59.9	71.8	55.5
Utilized in boiler.....	15,510,000	2,068,000	29.5	35.3	27.3
Wasted to stack at 500 degrees Fahr.	9,750,000	1,300,000	18.6	22.2	17.2
Total	56,710,000	7,560,000	108.0	129.3	100.0

These results are based on the following empirical data:
Size of heats, 75 tons.
Time per heat, 10 hours.
Hot metal in charge, 64 per cent.
Ratio, product to charge, 88 per cent.
Fuel consumption, 4,875 pounds per hour, or 650 pounds per ton.
Heat value of coal, 10,700 B. T. U. per pound.
Weight waste gases at boiler, 81,400 pounds per hour.
Co_2 in waste gases at boiler, 12 per cent.
Temperature waste gases at boiler inlet, 1,200 degrees Fahr.
Temperature waste gases to stack, 500 degrees Fahr.
Performance of boiler under above conditions, 60 boiler horsepower.

Heat Transmission and Boiler Design

The subject of heat transmission, although indispensable for the proportioning of boilers to perform the maximum economy under given conditions, is hardly within the scope of this paper, but the following general statements are not out of place: The rate of heat transfer, expressed in terms of "B. T. U. per hour, per square foot of heating surface, per degree mean temperature difference between gas and steam," usually ranges between five and eight for boilers and somewhat less for superheaters and economizers. The fact that the size of boiler is inversely proportional to the rate of heat transfer is evidence of the importance of this subject. A considerable amount of empirical data applying to various commercial types of boilers has been collected, and in future installations it is hoped that further investigations will be made.

Theoretical formulas and results of laboratory experiments are, as a rule, inapplicable in this work. The most essential factors conducive to high rates are clean surfaces and high gas velocity, the latter involving the direction of flow relative to the tubes. With water-tube boilers a good arrangement is to have the tubes in an approximately horizontal position with several vertical baffles, thereby enforcing the gases to impinge at high velocity against the tubes. However, in some cases it may be found more advisable that other considerations, such as the proportions of the available space, provisions for keeping the boiler clean, friction loss in the gas flow, etc., be given precedence in the design.

While the rate of heat transmission in the fire tubes is not as great as in water tubes of the same diameter and at the same gas velocity, yet it is possible that the advantages to be expected from fire-tube boilers especially designed for waste-heat purposes may

offset the loss in heat transfer. Among the points in favor of such boilers are simplicity, absence of air leakage, resistance to gas explosions and relatively low cost for the same capacity.

In order to maintain the maximum economy with any type of boiler it is absolutely essential that the heating surface be kept clean in the full sense of the word. This is one of the most troublesome operating problems, and, while frequent use of permanent and hand soot-blowers is fairly efficient, the design of the boiler should be such as to prevent as far as possible the lodgment of dust and to facilitate rapid and easy cleaning while in operation as well as idle. With the advent of pulverized coal for various heating operations, the subject of maintaining a clean boiler becomes of even greater importance, due to the large quantity of ash. In deciding on the type and location of the boiler it is desirable that the parts requiring frequent attention of the operator be above the charging floor, or where working conditions, such as ventilation, light and cleanliness, are better than under the charging floor. In many cases this eliminates all but the vertical type of boiler.

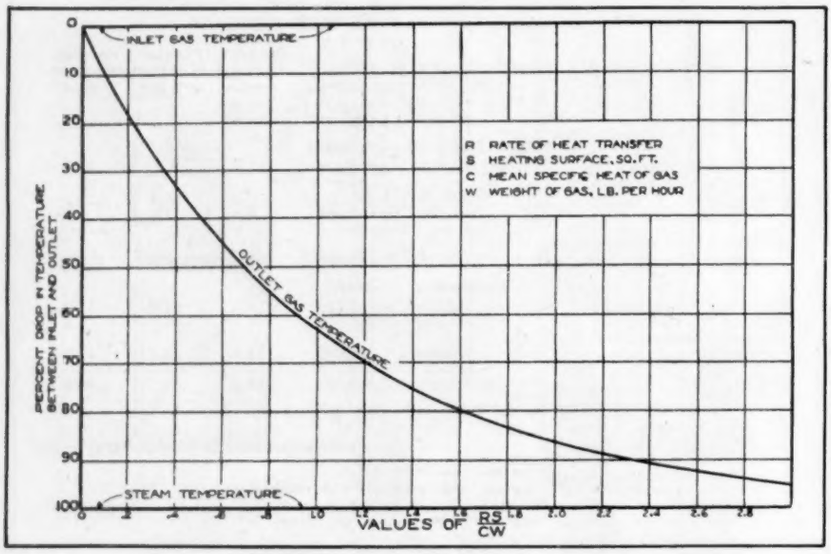


FIG. 6—CHART SHOWING DROP IN TEMPERATURE OF GAS PASSING THROUGH BOILER

Possibilities of Further Savings

While the savings herein pointed out represent a marked economy in open hearth practice, still there is opportunity for improvement in new installations by means of larger boilers and more attention to reducing the heat losses resulting from air leakage and radiation in the regenerative chambers, valves and flues.

The accompanying table shows what proportion of the heat delivered to the furnace may be utilized in a waste-heat boiler. This is based on reducing the gas temperature from 1,200 degrees at the inlet to 500 degrees at the outlet, and is the minimum performance that should be striven for. Although present boilers are showing very creditable savings, the outlet temperatures, neglecting the cooling effect of air leakage, are 600 degrees or higher, but the majority of these boilers are so situated that larger boilers could not be readily used.

Wherever space permits, the aim should be to reduce the temperature even as low as 400 degrees. The maximum net saving per ton of steel would then be realized, although not necessarily the maximum return on the investment. The size of boiler required for reducing the temperature from 1,200 to 400 degrees is two and one-half times the size for reducing to 600 degrees, yet at not a proportionately greater investment.

The initial gas temperature also demands further attention. Whereas now the average is not over 1,150 degrees for open-hearth furnaces in general, there is no question that it can be increased to at least 1,400 degrees. One source of loss is the practice of water-cooling the gas and air valves. Although not detrimental in ordinary open hearth practice, this results in a considerable loss when the recovery of waste heat is attempted. The heat thus lost may be recovered either by utilizing the cooling water for feeding the boiler or by substitution of brick-lined gas valves, thereby giving the waste gases a higher temperature on entering the boiler. Recovery of heat in the waste gases from regenerative soaking pits and heating furnaces presents additional encouraging possibilities, but as a primary consideration, means must be adopted for greatly reducing the heat losses and excessive air leakage which appears to be characteristic of these types of furnaces. Even if the gas temperature be considerably lower than in open-hearth practice, boilers will be found a paying investment. Heat recovery, by this means, does not cease to be economical until the temperature, at the boiler inlet, is as low as 700 degrees.

Fire Brick Booklet

Under the heading of "Interesting Facts", the Queen's Run Fire Brick Co., Lock Haven, Pa., has issued an exceedingly attractive booklet giving details of its history and growth. The manufacture of fire brick and the mining of fire clay was begun at Queen's Run in 1836. The weekly capacity of the plant at that time was 6,000 fire brick. This compares with a weekly capacity of 500,000 fire brick at the present time. Fire brick made at Queen's Run were used in the first hot blast anthracite furnace built in this country. This furnace was constructed in 1836 by Benjamin Perry, who was assisted by John Salmon, father of David Salmon, a former president of the fire brick company. The size of this blast furnace was 13 x 54 feet, its weekly capacity being about 50 tons. At the time the company began operations, the use of fire brick was limited to blast furnaces. This fact is of interest in connection with the present extensive use of fire brick in other manufacturing operations, such as glass potteries, forges, etc. At that time only 9-inch brick was molded. These bricks sold for $45 per thousand, transportation by canal or wagon costing three or four times as much. In 1887 the company's works were moved to Lock Haven. The booklet reprints three orders which were received more than 60 years ago for Queen's Run fire brick.

The Pittsburgh Iron & Steel Foundries Co., Midland, Pa., has issued several attractive cards describing its line of rolls. The company's roll capacity has been increased recently by the addition of another open hearth furnace and other equipment.

An employe was holding a bar while another was striking with a sledge. He missed the bar and the employe holding the bar was struck over the eye. Had tongs been used to hold the bar the accident would not have occurred.

Chart for Conveyor Belt Calculations

By J. D. Mooney and D. L. Darnell

THE accompanying chart has been drawn for the convenience of engineers as a means of quickly determining the correct number of plies of conveyor belts operating under specific conditions. The calculations are based on the average safe strength with a factor of safety of 15, of the various standard rubber conveyor belts. The calculations assume maximum loading conditions; that is, the belt is considered as carrying the greatest load that it will handle without spillage at ordinary belt speeds. This not only produces the most economical operating conditions, but also the maximum tension in the belt.

The chart is a graphical representation of the formula:

$$p = kgW(L + 10H)$$

Where—

p = the correct number of plies
k = a constant, depending on the type of drive
g = the weight in pounds per cubic foot of material handled
W = the width of the belt in inches
L = the length of the belt in feet
H = the difference in elevation between the head and tail pulleys, in feet.

For a simple drive, with a bare pulley, $k = \frac{1}{250{,}000}$

For a simple drive, with a rubber-lagged pulley, $k = \frac{1}{300{,}000}$

For a tandem drive, with bare pulleys $k = \frac{1}{375{,}000}$

For a tandem drive, with rubber-lagged pulleys, $k = \frac{1}{455{,}000}$

The chart is drawn for a simple drive, with a bare pulley, therefore, the number of plies obtained from the chart should be multiplied by the factor 0.83 of 5/6 for simple, lagged drive; the factor 0.67 or 2/3 for tandem, bare; and the factor 0.55 or 11/20, for tandem, lagged.

The formula $p = kgW(L + 10H)$ has been developed mathematically from the following formulas, which have been found to work very satisfactorily in average good practice:

$$U = \frac{0.08W^2Sg}{5{,}000}$$

$$HP = \left(\frac{0.02l}{200} + \frac{0.01H}{10}\right)U$$

$$T = \frac{C \times HP \times 100}{S}$$

$$p = \frac{T}{24W}$$

Where—

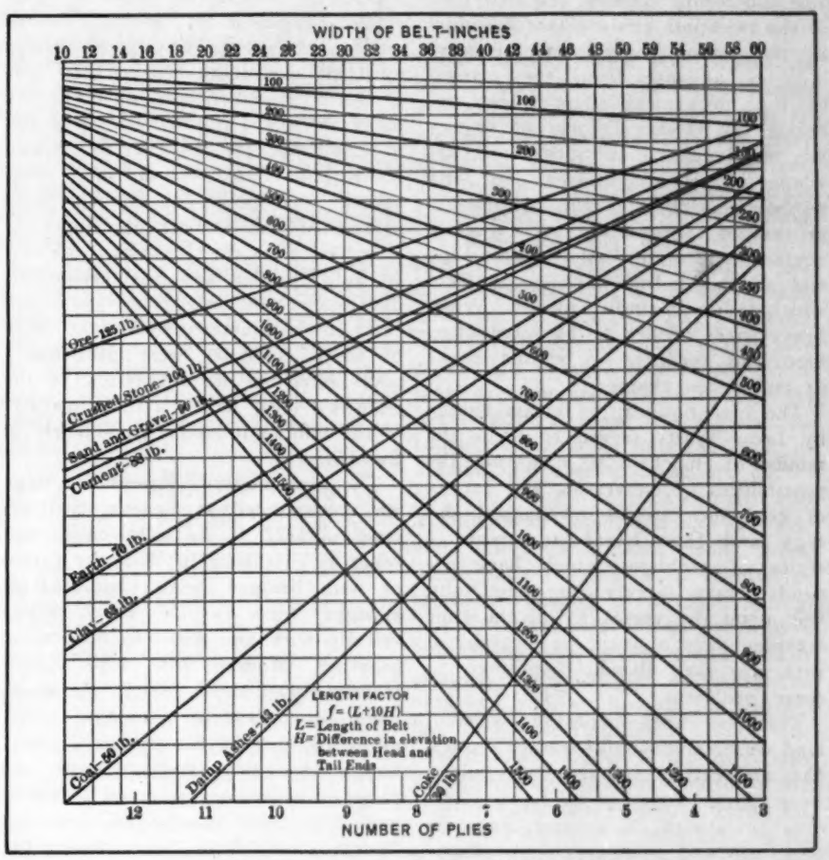
U = Capacity in tons per hour
W = Width of belt in inches
S = Belt speed in feet per minute
g = Weight per cubic foot of material handled
HP = Horsepower developed in driving conveyor belt
l = Length of the conveyor, in feet (approximately $\frac{1}{2}L$)
H = The difference in elevation between the head and tail pulleys, in feet
T = The total tension in the belt, in pounds
p = Correct number of plies
C = The constant of the drive.

For a simple drive, bare pulley.....$C = 600$
For a simple drive, rubber-lagged pulley .....$C = 500$
For a tandem drive, bare pulley.....$C = 400$
For a tandem drive, rubber-lagged pulleys .....$C = 330$

The length factor, $f = (L + 10H)$, represented on the chart by the lines 500, 600, 700, etc., is a developed factor equal to the sum of the length of the belt and ten times the difference in elevation between the head and tail pulleys. To find the correct number of plies for a conveyor belt, knowing the width, the length, the difference in elevation between the head and tail ends, and the kind of material to be handled:

Start from the width given at the top of the chart and move down until this line intersects the line corresponding to the proper length factor; then move either right or left until the line corresponding to the given material is met; then move down again to the scale of plies, where the next largest figure will give the correct number of plies.

For example: To find the correct number of plies for a conveyor belt 36 inches wide and 300 feet long, with 20 feet difference in elevation; handling sand and gravel: Follow the line from the 36-inch width downward until it intersects the 500 length factor line; then follow to the right until the sand and gravel line is intersected; then down to the ply scale, where the ply will be found to be seven.


WIDTH OF BELT—INCHES
10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60
Ore—125 lb.
Crushed Stone—100 lb.
Sand and Gravel—90 lb.
Cement—90 lb.
Earth—70 lb.
Clay—65 lb.
Coal—50 lb.
Dump Ashes—45 lb.
Coke—25 lb.
LENGTH FACTOR
$f = (L+10H)$
L = Length of Belt
H = Difference in elevation between Head and Tail Ends
12 11 10 9 8 7 6 5 4 3
NUMBER OF PLIES

CONVEYOR BELT CALCULATING CHART

It is claimed that alcohol affects the brain about three hours after the drink is taken. The Minnesota labor report shows that the greatest number of accidents happen at 10 o'clock in the morning and at 3 o'clock in the afternoon; just at the time when the largest amount of alcohol would be in the brain from the drinks taken as the man goes to work.

The United Smelting & Aluminum Co., New Haven, Conn., has completed its new plant for the manufacture of aluminum ingots, alloys, etc. It is equipped with 17 modern melting furnaces and the necessary auxiliary equipment for economically handling materials.

A paper presented at the San Francisco meeting of the International Engineering Congress, September, 1915.

Wire Rope: A Factor in Steel Making

FROM the mine to the machine shop, in fact, to the consumer, wire rope is an essential factor in the manufacture of steel products. Modern iron mining methods, colossal as they are, would be impossible were it not for the quantities of cable used. The handling of the ore, its smelting, refining, and evolution into finished iron and steel products, demand the employment of wire rope in many different operations.

By James F. Howe

TO DESCRIBE fully the different phases of wire rope usage which have become inseparably linked with modern steel manufacture and to analyze the reasons which have led to its general adoption will be the object of this article. The nineteenth century and that part of the twentieth century that has now become history have seen the steel industry advance from the manual to the mechanical stage. More recently the electrical form of energy has supplemented and broadened the whole art of steelmaking. So long as man was content with the manual process of steelmaking there was, of course, little or no call for wire rope and many kindred articles of steel which today are indispensable. When heavy loads needed to be lifted mankind had recourse to manila ropes or bulky iron chains.

The invention of the steam engine by Isaac Watts served to focus the minds of mechanical men on the possibilities of converting the energy of coal into useful mechanical energy and thus began to create a series of problems which have depended very largely for their solution upon the versatility of the rope manufacturers and the application of wire to the ultimate solution of these problems.

The first ropes employed by mankind were composed of leather thongs, flax, and certain wooden fibers which were twisted together by hand. Records sculptured on ancient Egyptian structures and sepulchers show clearly that ropes were used by mankind as early as 3,000 B. C. Herodotus informs us that Xerxes brought his tribes across the Hellespont, now known as the Dardanelles, by means of two bridges each supported by six cables. This is the earliest mention of the principle of the suspension bridge.

Numerous wonderful things have been attributed to the city of Pompeii and one story has it that excavations on the site of this ancient city are said to have discovered a piece of bronze wire rope of about ½-inch diameter, consisting of three strands of 15 wires laid together spirally. The supposition is that these ropes were used to operate cranes by means of slaves, who, in tread-mill fashion, worked a large drum, to which was attached a small drum carrying the ropes. It is evident, however, that ropes composed of separate wires were not used to any great extent until the nineteenth century. In 1644 a Dutch engineer, Adam Wybe by name, devised a tramway to carry dirt in small buckets from a hill named Du Biscoffs Berg over the town moat to the fortification of Danzig. This is one of the earliest appliances of what is now the modern tramway. In both Sweden and Switzerland the development of aerial tramways began early in the nineteenth century. Both of these countries were particularly well suited to the adaptation of the tramway idea, which assisted greatly in the mining industry, particularly in Sweden.

The first modern suspension bridge was constructed at Geneva, Switzerland, in 1822, to be followed by another at Friedberg in 1835, the cables of both bridges being composed of straight wires which were served spirally with fine wires to hold them together. Modern wire rope manufacture began about 1821 in Germany, when Mr. Albert, of Clausthal, introduced what was known as "Albert Lay". This same style of rope was patented in England in about 1840, and was called after the English inventor, "Lang Lay." This latter name has been applied to that particular style of rope in all English-speaking countries.

Formerly Made in Rope Walk

The art of rope manufacture developed gradually, and on suspension bridges straight wires were used bound together with fine wires spirally served around them. This formed a sort of a cable. The twisting of the wires into strands and of the strands into rope was done in the early days on an old-fashioned rope walk. The length of rope made was of necessity limited to the length of wire that could be handled and the length of the rope walk which was desired. With the gradual introduction of machinery the practice of rope-making advanced from the hand to the mechanical stage. One of the fundamental advances which was made in rope manufacture was the introduction of a hemp core. When this was done, successful ropes from the users' standpoint began to be put forth. The first wire rope manufactured in the United States began in 1840 and in 1855 the suspension bridge at Niagara Falls was built for the use of railway trains. This was followed in 1869 by the Brooklyn bridge, which was completed in 1883 and remained for many years one of the most remarkable engineering feats of the times.

The earliest modern applications of wire rope were largely in connection with the mining industry, particularly in connection with coal and metal mining. The wire ropes were employed for haulage purposes, being attached to cars bearing coal or ore and delivered by an incline to the mouth of the mine. Such ropes, of necessity dragged on the ground or over railways, were made of coarse wires to withstand this particular service. The usual type of rope was employed, or six strands of seven wires. The mining industry had to depend largely upon working such mines as could be handled by means of wire rope of this character. This system of mining still exists to a large extent and can be found in numerous installations, particularly in Pennsylvania, along the Monongahela river, where coal mining is well adapted to the use of wire rope haulage.

Three distinct systems have developed in connection with mine haulage work, namely: The endless haulage rope system, the tail rope system and the gravity hoist or inclined plane system. In the first the wire rope is spliced endless, and is passed several times around double drums, in order to get tractive power. A suitable counterweight to maintain tension is usually provided outside of the mine and adjacent to the engine house. In this system of operation, cars are gripped to the rope at regular intervals and the operation is slow but continuous. The rope is supported

A paper read at the ninth annual convention of the Association of Iron and Steel Electrical Engineers, Detroit, Sept. 8 to 11, 1915.

by idlers and turn-sheaves properly spaced to prevent the rope from dragging and wearing itself out unduly. Full cars of coal or ore are attached at intervals and this system works very nicely where the rope is not unduly strained. Ropes varying in size from ¾-inch to 1¼-inch diameter are usually employed for this work. Ropes up to 15,000 or 20,000 feet long are not infrequently used in systems of this character.

The tail rope system consists of two separate ropes, one known as a head line and the other as a tail line. The driving mechanism consists of two distinct drums operated by means of a steam engine with independent clutches. The head line has the heaviest duty; its work is to pull the loaded cars from the mine. The tail rope is required to pull the empty cars back into the mine. In operation the system is arranged so that a group of cars up to about 50 in number are attached to the head line. The tail line is attached to the rear end of the train of cars and is paid out as the head line is wound in. With this system the speed is higher on account of the intermittent character of service, speeds approaching 10 miles per hour being about the average. There are mines requiring tail ropes up to 20,000 feet with head ropes 10,000 feet long. In conjunction with these ropes there are frequently branch tail lines.

The gravity hoist or inclined plane is a system largely used where a mine entrance is situated on a side hill at considerable distance above the railroad tracks and loading tipple. It consists usually of a large drum or pair of drums, with suitable brakes. One end of the rope is attached to the loaded cars, while the other end of the rope pulls the empty cars back up to the mine entrance.

Safety an Important Factor

These three systems are largely used in mine work in connection with the steel industry of the present day. To a certain extent some of them have been superseded by electric haulage, but where grades are steep the wire rope has continued to be largely used on account of the safety of the operation. From the early use of wire rope on inclines in mines, there has been a gradual development of constructions and qualities of wire for the various uses to which wire rope is put. For shaft mining of iron ore and coal, for instance, the rope which is ordinarily used for haulage is too stiff. Consequently, there has been developed a spiral hoisting rope consisting of six strands of 19 wires. This rope has a very large and extensive use, not only for mine hoisting work, but for many other purposes in connection with steelmaking. Shaft mines are very extensively used in the mining of iron ore and coal and very large amounts of wire rope are employed about this class of mines.

Severe Stresses on Rope

An important point in connection with the use of wire rope for mine hoisting is the question of stresses in the rope other than those due to the dead weight of the load hanging on the rope. If one will stop to think a moment, it will be self-evident that the use of wire rope involves stresses of acceleration and retardation. The greater the speed at which a rope operates, the greater will be the effect of these stresses. It is necessary, therefore, in using a wire rope in work of this character, to take into account the stresses due to acceleration and retardation. It can be shown, for instance, that an acceleration of eight feet per second will reduce a factor of safety of 10 for a quiet load down to five for a moving load. This point has been carefully brought out recently and recommendations have been made to the bureau of mines regarding this matter, which will cover this point. Briefly these recommendations are as follows:

Length of rope.	Minimum safety factor for new rope when maximum acceleration is used.	Minimum safety factor when rope must be discarded.
500 feet or less	8	6.4
500-1,000	7	5.8
1,000-2,000	6	5.0
2,000-3,000	5	4.3
3,000 and over	4	3.6

It is all right in the majority of cases to take the breaking strengths of ropes as given in the manufacturer's published table, to determine the factor of safety. Certain recommendations have also been made in regard to the rate of acceleration, of which the following figures show the results in comparison with the table given previously. Acceleration or different hoisting speeds should in no case exceed the figures given, as follows:

Speed in feet per minute.	Maximum acceleration in feet per second.	Minimum time corresponding to acceleration in which to attain the rate of speed corresponding thereto.
500	4.16	2 seconds
750	4.16	3 seconds
1,000	5.55	3 seconds
1,250	5.95	3½ seconds
1,500	6.25	4 seconds
2,000	8.33	4 seconds
2,500	8.33	5 seconds
3,000	8.33	6 seconds
3,500	8.33	7 seconds

A third table showing the maximum hoisting speed for shafts of different depths has been proposed as shown below:

Length of rope in shaft.	Maximum hoisting speed in feet per minute.
500 feet or less	1,200
500-1,000	1,600
1,000-1,500	2,000
1,500-2,000	2,000
2,000-2,500	2,250
2,500-3,000	2,500
3,000-3,500	2,750
3,500-4,000	3,000
4,000-4,500	3,250
4,500-5,000	3,500

These recommendations, while they apply directly to mines, are also, to a certain extent, applicable to other wire rope applications, and the principles involved should be carefully considered in any installation where wire rope is worked under rapid acceleration.

Uses on Ore Docks

Coming now to the point where the iron ore or coal is at the surface of the ground and ready for transportation, we find that wire rope is used in every operation of the steel manufacture, and I will endeavor to briefly trace the various kinds of wire rope which are most generally used. The iron ore, having been dumped into cars, is transported to the docks at suitable points, such as Two Harbors, Duluth, Marquette and other lake ports, and dumped into bins. These bins are so arranged that by the lowering of a spout the ore can be transferred directly into the hold of a boat. To operate these ore chutes we have a flat wire rope composed of a number of ropes laid side by side and sewed with soft iron wires. These flat ropes wind upon themselves after the fashion of a clock spring. The lowering of the iron ore into a boat takes a very short time. The boat in which the ore is transferred uses wire rope exclusively for rigging, life lines, steering, etc. When the boat reaches its dock at the lower lake ports, various unloading machines are employed to take the ore from the boats and to load it into cars or on stock piles. Several kinds of machines are used for this work, but all of them employ wire rope to a large extent. In cases where the ore is transferred to stock piles a large ore bridge is usually employed with clamshell. It is possible, with mechanical and electrical facilities now employed, to unload a cargo of 10,000 or 12,000 tons in four hours. Any one who has witnessed the unloading of an ore boat has realized at a glance the importance of wire rope in handling this problem.

The iron ore from the boats or stock piles, as the case may be, is loaded into broad gage cars at the docks for transportation of the ore to the blast furnaces. On the largest

docks, in order to facilitate the handling of the cars, several haulage ropes of 1⅛-inches to 1½-inches diameter, running at about two to three miles per hour, are used. These ropes are used to spot the cars in the proper position for loading the ore under the hoppers of the various unloading machines. This is accomplished by means of a short piece of cable with a hook on one end and a powerful cam clamp on the other end. The hook is attached to a car truck and the grip is attached to the cable, thus moving one or more cars any distance necessary within the scope of the cable installation. The advantage of such a system is obvious and the economy of switching is very great. Ropes used at the docks at Ashtabula and Conneaut usually last two seasons on this class of service. On account of the grit from iron ore which comes in contact with the haulage cables at times, it is necessary to use the highest grade plow steel wire to withstand the abrasive wear. These haulage cables are about 4,000 feet long and are spliced endless.

Many Types of Clamshell Buckets

It would take too much time to describe in detail all the types of ore handling machines, all of which depend for their success on some form of clamshell bucket. The size of clamshell varies in size from 2-ton on the oldest rigs to about 20-ton on the largest ore bridges used in stock pile work. Those which are most economical in the use of wire rope are the types which have the simplest and most direct path of rope travel and the fewest bends. Various constructions of rope are employed in clamshell bucket work, but generally on ropes 1 inch in diameter and smaller, it is customary to use 6 x 19 ropes of plow steel or monitor quality. On larger ropes the construction is varied and 6 x 37 ropes are used more or less. It is difficult to give a general recommendation that will cover different types of clamshells. In this class of work a little change frequently makes a great difference in the service obtained. One new type of rope that has worked well on some types of clamshells is the steel-clad type, which is just an ordinary rope with a flat steel armor wrapped around each strand. Such ropes have improved the service of many difficult rope uses.

Not all steel plants are located at interior points; in fact, there are many of them located at various points along the Great Lakes, and even now plants are being erected at points near the iron mines. The blast furnace depends for its operation on a constant supply of iron ore, coke and limestone, which is fed into the furnace by means of a skip hoist which, except for length, is in many cases a duplicate of an iron mine shaft of slight pitch. Rope conditions for this class of service can be made very good as a rule, on account of good leads and steady loads. It is very seldom that unsatisfactory rope service is found on such installations.

Use in Steel Mills

In the steel mill, whether bessemer or open hearth, we have large ladle cranes handling molten metal from the furnace to the casting pit where the ingots are poured. For this work it is customary to use the 6 x 37 plow or monitor crane rope. On account of the heat it is customary to make these ropes with a soft iron stranded core in place of the ordinary hemp which prevents the drying or burning out of the heart of the rope.

The consideration of wire rope problems involves three distinct factors, all of which are essential to successful use of wire rope. Briefly, these are as follows: Proper manufacture, use of the proper construction and quality, right use of the rope itself.

The first essential, proper manufacture, is one that is strictly up to the manufacturer of a wire rope, and the manufacturer is responsible for this feature. The second essential, use of the proper construction and quality, is one in which the manufacturer and the user share in responsibility. If the user specifies the type and construction of rope, then the user alone is responsible, but if the manufacturer recommends a certain construction, then the manufacturer assumes a certain responsibility. The few failures that are occasionally recorded in wire rope usage are due to a misunderstanding on the part of the user or manufacturer as to the conditions of service under which the wire rope has to work, and the more information that a manufactuer has as to the use to which a wire rope is put to, the more quickly will he be able to tell whether customer has ordered the best construction or quality of rope for the purpose. Some manufacturers maintain a well organized engineering force, whose duty it is to compile data and statistics on rope usage and to recommend to customers the proper construction of rope to be used.

The company with which I am connected maintains such a system, which has been found to be of great assistance in getting the best service from the wire ropes which it manufactures. The third essential to successful wire rope usage is the "right use of the rope itself". This feature is one in which the user has to bear the full responsibility because he alone knows what he is going to do with the rope. Certain things are sometimes done with wire ropes that result in rapid deterioration and disintegration of the rope. The ideal rope installation, therefore, is one where all three essentials are present, and this I believe constitutes probably the majority of wire rope in use today.

In the manufacture of wire ropes very careful inspection is constantly made of all processes of manufacture. Each coil of the wire is rigidly tested before it is manufactured into rope. The art of rope-making itself is thoroughly studied in the construction of each size of rope and the proper sizes of wire are grouped together to form the strands. A very even and uniform diameter hemp center must be employed in the laying up of the finished rope, and when completed the wire rope is a very reliable product. The number of different wires in a rope is such that the breakage of a single wire decreases but slightly the ultimate strength, and therein lies the supreme merit of this product. Other types of rope, such as manila rope, may contain short fiber or low strength fiber, but a wire rope with continuous wires of tested and carefully drawn material represents a high degree of perfection.

Revision of Breaking Tests

I desire to briefly call your attention to the question of testing wire rope, which has assumed a very important place at the present time. Some years ago it was the practice of manufacturers to test the individual wires and to add the strength of these wires together. This gave what was called the breaking strength of a wire rope. It was realized, however, that this was not the actual strength of the rope, and small specimens upon test showed a lower strength than that calculated. About five years ago this led to a revision, by the rope manufacturers, of their actual strengths, taking into account the actual breaking strengths of the ropes, and not the calculated strengths. The calculated strengths were based upon straight wires. The actual strengths, as now used, are based upon twisted wires. The twisting of the wires into the rope means that each wire pulls at a certain angle and its efficiency is less than unity. Consequently, a full size specimen of rope will break at a figure less than the aggregate

strength of the wires taken singly. The amount of difference depends upon several conditions—chiefly upon the angle of lay of the strands and the rope. In very few cases does this run over 90 per cent and in average ropes the figure is probably nearer to 82 or 85 per cent.

The testing of full size specimens of rope is a very interesting proposition. It is done by what is known as the socketing method. The ends of a specimen of wire rope 4 or 5 feet long are equipped with wire rope sockets attached by molten zinc, and then the sockets are inserted in a large testing machine. The loads are gradually applied until rupture occurs. It usually happens that two strands or more will break in between the sockets. At the point where this break occurs the maximum load is recorded as the strength of the finished rope. Tests of all sizes of rope from the smallest to the largest are constantly being made by our company, and as a result of these tests much valuable information as to the behavior of ropes under load has been obtained. We know, for instance, that whereas the modulus of elasticity of steel is from 26,000,000 to 29,000,000 pounds, the modulus of elasticity of ordinary hoisting ropes will run from 10,000,000 to 12,000,000 pounds. The lower modulus of elasticity of the steel rope as compared with the solid steel indicates its greater flexibility, due, of course, to the twisting process which the wires have gone through. This lower modulus and increased flexibility are very essential in wire ropes where they have to go around sheaves and drums, and constitute the principal reasons for the durability of wire ropes for such purposes.

Securing Best Service

It is surprising sometimes to notice the comparatively small diameter of sheaves and drums around which wire ropes have to operate. The service which a wire rope gives is, of course, determined by the set of conditions under which it operates. No wire rope, of course, will give maximum service when subjected to undue abrasion and exceedingly heavy bending stresses around comparatively small sheaves. The ideal condition for rope service is one where drums and sheaves are of ample size, abrasion is normal, and loads are not too heavy. It requires a close study of conditions to determine which style, construction or quality of rope will give best service under a given set of conditions. It is this point that has led to the multiplication of constructions and various strengths of wires. It is possible, for instance, to accomplish the same results, as far as the hoisting capacity is concerned, by the use of several different sizes of rope but each of equal strength. It is possible, for instance, to use a 1¼-inch, 6 x 19 crucible rope with a strength of 40 tons or a 1⅛-inch diameter, 6 x 19 plow steel rope with a strength of 47 tons, or we could almost use a 1-inch monitor rope with a strength of 45 tons to do the same work. If flexibility is required, for instance, a 1¼-inch, 6 x 19 rope would be no more flexible than a 1⅝-inch diameter, 6 x 37 rope, or a 2¼-inch, 6 x 61 rope.

Theoretical vs. Practical Installations

It will thus be seen that it is an easy matter to secure flexibility, but when flexibility is secured, it is at a sacrifice of a certain amount of abrasive resisting action. The more flexible ropes have more wires and smaller wires in the same diameter than do the less flexible ones. Consequently, the problem resolves itself into maintaining or securing the style of construction that will give maximum durability into these several conditions which have to be met. In the steel manufacturing industry, for instance, it has been found that as a rule the plow steel or monitor grades of rope are more durable on account of the resistance to the abrasion due to dust, iron ore, dirt, etc., which are encountered in the various manufacturing processes. A further element enters into the problem because the diameter of the rope in the higher grades of material is smaller, and, consequently, wherever it is possible to use the higher grades of material, the efficiency is increased. This will apply to any and all installations of wire rope.

Another problem which frequently enters into consideration is the question of the number of parts of wire rope which should be used to handle a given load. One can use, for instance, anything from a single end piece of rope up to a good many different parts of a smaller rope. Theoretically, a large number of parts of rope will hoist as well as a lesser number, but in practical service it has been found that a surge of load frequently occurs when a hoist is being made. This may be due to the quick application of brakes or something of the sort, and applies a heavier stress than the ordinary hoisting load. If there are a large number of parts and a rope is stopped quickly, it takes a certain amount of time for the increase in load to distribute itself around among the different parts of rope so as to make the load equal on each. I have seen cases where, owing to too great a number of parts of small rope the load did not have sufficient time to distribute itself and as a result the rope broke, due to the inertia strain put upon it.

To my mind, therefore, it seems advisable to get the power wherever practicable, by using a fairly large size rope, rather than by decreasing the diameter of rope and increasing the number of parts. This is particularly true in steel mill work where large ladles of molten metal have to be raised and lowered frequently. I think, for instance, that 12 parts of ¾-inch rope on a hoisting crane are not as good as eight parts of 1-inch. The safety of the eight parts of 1-inch rope is much greater than that of the 12 parts of ¾-inch rope, although the strength of each is approximately the same. The load will distribute itself around through eight parts of rope more quickly than through 12. Of course, I know that the use of a smaller rope permits the use of a smaller sheave, and this is some advantage, but there is still another factor to be considered and that is the wear of the ropes around the increased number of sheaves. A ¾-inch rope which has to pass through sheaves in a 12-part block will wear out more rapidly than a 1-inch rope which only has to pass through eight parts. The wires in a ¾-inch rope are smaller and less durable than those in a 1-inch rope. These factors, when carefully considered, I think will lead to the specifying of the larger size of rope, provided, of course, the sheaves can be maintained of suitable size. On crane rope composed of six strands of 37 wires, for instance, where diameters of sheaves can be maintained to 30 times the diameter of the rope, the larger size of rope that can be used, the better the conditions will be.

Sheaves and Drums

There are a number of practical points in connection with wire rope installation and usage, which it is well to carefully consider in order to obtain the maximum amount of service from a wire rope installation. Most wire rope applications use sheaves under which the rope runs and drums upon which it winds. The effect of two small sheaves and drums is readily shown by the short life of such installations. This is caused by the bending stress in the material of which the rope is composed. As a general rule, the bending stress should be kept at as low a value as possible in order to secure the best results. There are some classes of machinery, however, where it may be necessary to sacrifice the life of the rope for the sake of greater economy in other respects. It should be borne in mind,

however, that the rope service is the last thing to be sacrificed on an installation because the user of a wire rope is the one who must pay the penalty for the short service which is due to poor design or arrangement of sheaves and drums. In many cases it is competition which causes the reduction in diameter of sheaves and drums, but if this point is watched where a piece of apparatus is to be purchased, and the diameters of drums and sheaves specified, then the rope service can be made fairly satisfactory. A good rule which is used by a number of machinery builders and adopted by some of the steel companies, specifies that the diameter of the sheave on a rope of six strands, 19 wires shall not be less than 40 times the diameter of the rope, and that of the sheave on a rope of six strands, 37 wires, not less than 30 times the diameter of the rope.

This rule, of course, would apply to other machinery than mine hoisting or blast furnace skip hoist work. In some cases it is not possible to get sheaves as large as this in clamshell buckets, consequently the end of the rope operating in a clamshell wears out more rapidly than the remainder. In such cases it is highly advisable to have a drum of sufficient size that an extra amount of cable can be stored upon it so that the outer end of the rope can be cut off several times and thus increase the life and economy. On machinery wherever possible, it is advisable to use drums that are grooved because the grooving permits the rope to lead better and it also furnishes a support for the rope, which is not secured when a flat drum is used. The grooves on a drum for any wire rope should be made slightly larger than the rope which is to run upon the same. For instance, on a 1-inch rope, a groove should be turned about 1/32-inch larger than the diameter of the rope. There should always be a clearance of about ⅛-inch so that the ropes will not get side wear when they wind on the drum. On a 1-inch rope, for example, the center to center distance of the groove should be approximately 1⅛-inches.

Cases have come to my notice where the center to center distance of grooves was made the exact theoretical diameter of the rope and the grooves themselves were turned to this same theoretical size. The result has been that it has been difficult to get good rope service. Any rope when it is new is liable to be slightly full size, owing to the fact that the hemp center must be a trifle large when the rope is new, as otherwise the rope will not give its best service. Mention has already been made of making drums sufficiently large to carry the length of rope, but there is another point which should not be overlooked. It is bad practice for a rope to overwind, that is, to be wound in more than one layer on a drum. It will readily be agreed by every one who has ever noticed this condition that a wire rope will mash and jam more or less and will not last nearly as long. It is sometimes a little more expensive to provide a larger or a wider drum, but for the best working conditions the overwinding of a rope cannot be condemned too strongly.

Alignment of Sheaves and Drums

Wherever there are a series of rope sheaves around which the rope has to pass, it is very essential that they be properly aligned in order to prevent the grinding out of the flanges of the sheaves and unusual wear on the rope. A bad alignment of sheaves is sometimes due to faulty design and sometimes to poor upkeep. In either case the result is the same. I have seen rope installations where satisfactory service was impossible owing to the combination of bad alignment of sheaves and improper leads. The proper alignment of the sheaves involves necessarily the choosing of the proper angle of lead. Take for instance where a rope has to wind on a drum and is, say, three feet wide. At some portion of its travel the rope does not exactly line up with the sheave over which it runs, but the best practice is to have the sheave lined with the central portion of the drum on which the rope is wrapped, and the lead angle should not exceed one degree 30 minutes.

When a sheave becomes badly scored or worn a new rope will not work properly and it is necessary to either change the sheaves or turn out the grooves. The scoring of sheaves and drums is incident to the operation of machinery and cannot be avoided. This trouble has been partially eliminated. The use of manganese steel sheaves in many cases will reduce the wear to a very small quantity. Of course, the manganese steel sheaves are more expensive originally, but in many cases they will outwear a number of the ordinary cast iron or chilled iron sheaves, and hence, it is economy to use them both from the standpoint of economy and better rope conditions.

In the layout of a machine it occasionally happens that the wire rope installation is the last problem considered. The result is that the path of rope travel is complicated by numerous bends, some of which are reversed from the bends which just precede them. This is a particularly bad condition of wire rope service and it has a marked tendency to decrease the life of the rope. It cannot be too strongly condemned. It is very essential that a diagram showing the rope travel be laid out at the beginning of the design of a piece of machinery. It will then be possible, in a vast majority of cases, to secure the same results without the use of the reverse bend. I think one reason why reverse bending has been so common is the fact that its bad effect has not been fully realized by machinery designers. The flexibility of a wire rope has been realized, and on this account the path of rope travel has been made very crooked and unscientific. It is possible, even on machinery that is already installed, by a careful study, to eliminate reverse bending and sometimes to take out unnecessary sheaves. There is no way in which rope service can be improved more readily than by the elimination of such adverse conditions.

In the manufacture of wire rope every precaution is taken to see that no torsion is put upon the wires when they are made into strand and when they are laid up into rope. The rope is carefully wound upon reels or in coils in the same manner. It not infrequently happens, however, that when a piece of rope has to be handled in installing it, it is given all kinds of abuse. This is sometimes due to carelessness and sometimes to an attempt to expedite such installation. Really, a little more time taken on careful installation will repay itself in the long run. A wire rope should not be coiled or uncoiled like a hemp rope. It is structurally different, and if it is in a coil it should be unrolled on the ground like a hoop. If it is on a reel, the reel should be mounted upon jacks so that the rope will unwind properly. The rope should never be pulled off the head of the reel when it is lying flat on the ground. I have seen instances where ropes have been installed on derricks and run for several days. The customer then complained that the rope was not behaving properly. The minute a slack came into the rope it looked like a corkscrew. The trouble was simply due to the fact that the installation was not properly done. The corkscrew effect was due to the running of the rope with the twists in it, and after a few days these twists are swaged into the rope in such a manner that they can never be taken out.

Wherever possible wire rope should be lubricated at such intervals as the conditions of service require. When originally manufactured, most ropes

are thoroughly lubricated both internally and externally. A rope that is allowed to become rusty cannot remain pliable. The power that is expended in operating a rope which is defectively lubricated is considerably increased. As an example of this I need only state that experiments which have been made in our factories have shown that a dry rope when spliced endless and run at a constant speed will get so hot that it cannot be touched. A lubricated rope under the same conditions will scarcely be warm. It is simply the case of transferring mechanical energy into heat. This heat may reach a point which will affect the quality of the material in the rope, but aside from this it indicates a condition of rapid deterioration because the wires in the rope do not have the opportunity to adjust themselves to the bends around sheaves or drums, and consequently they begin to break up much more quickly than they should.

The proper kind of lubricant to use varies with the conditions of service. In some cases a light lubricant is necessary; in other cases a heavy material. In general, the lubricant used on a wire should be free from acid or alkali. There are some paraffine oils, for instance, which contain alkali, due to the method of refining the oil. These are as bad to apply to a rope as is a lubricant containing acid.

No general rule can be given as to exactly what this factor should be, but the selection of the proper factor is a matter of vital importance in all wire rope usage, because it is this point which determines to a certain extent the length of life of the wire rope when in service. Where ropes are moved very slowly without sudden or noted strains, the factor of safety can be lower than where the loads are moved rapidly and the load fluctuates.

Proper Safety Factor

Another point which needs consideration is the question whether life or limb is at stake. In such cases the factor of safety should be somewhat greater than where this factor does not enter. It has been the habit of rope manufacturers to recommend a factor of safety of five. This, however, is only for rough calculation because all manufacturers realize that a factor of safety of five on certain classes of work is not sufficient. On open hearth cranes, for example, where molten metal is being handled, this factor of safety should not be less than eight. On ore handling machinery where clamshell buckets are used, the factor of safety should run up to eight or ten for the static load. It is not so much the question of what the initial factor of safety is in a good many cases, as it is what the factor of safety will be when the rope is to be discarded. The higher the factor of safety originally, the longer the rope can be kept in service with safety. This is, of course, the keynote of durability, and while it will cost a little more originally for ropes with this larger factor of safety the increased life, assuming that conditions are similar as regards relative proportion of sheave diameter in both cases, will well warrant the use of the larger factor. It is not necessary, however, to go to extremes and for an abnormally large factor of safety cost, this will not assist materially in the economy of rope operation. It would be the same, for instance, as using a 100-ton crane for picking up loads of 10 tons.

Discarding of Ropes

This is another subject on which it is difficult to lay down general rules and it is essential to consider the character of the service and the rate of deterioration before laying down rules for discarding a rope. An occasional broken wire in a rope of six strands of 19 wires, would mean, for instance, a loss of less than 1 per cent in the breaking strength of such a rope. A number of broken wires at a single point within a few inches of each other will decrease the strength of the rope by at least a number of broken wires. If one strand has been injured by the cutting of six or eight wires through accident or otherwise, the probability is that if a heavy load comes on this rope, this one strand will part owing to its weakened condition, and thus necessitate the removing of the piece of rope. The points to be looked out for are to see that no local injury of such a kind occurs, and if it does, to remove the rope before it has a chance to break. A rope that is worn down so that the wires are from one-third to half way worn through and contains no broken wires is frequently kept in service, while a rope containing one or two broken wires is removed. In all probability the worn rope is not as strong as the rope containing the one or two broken wires. Both external wear and number of broken wires should be taken into account. The construction of the rope also has a bearing upon the question of when a rope should be taken out. For instance, a rope containing six strands of seven wires and having six or eight broken wires in a distance of 1 foot is in a far more dangerous condition than a rope of six strands of 19 wires, having an equal number of broken wires, and should the rope contain six strands of 37 wires, the condition is still better. The essential point is to have ropes inspected at regular intervals and careful records kept of such inspection. On open hearth cranes, for instance, a regular daily inspection by the crane operator and a weekly inspection by a special representative of the master mechanic will usually disclose the condition of the rope so that it can be removed in ample time consistent with the safety of the hoisting mechanism.

It is well to have those who inspect ropes given instructions to note carefully, not only the number of broken wires, but their general location; also, the wear on the rope and the condition of rope, whether rusty or lubricated, etc. The condition of rope near the fastenings or where it goes over the equalizer sheaves should receive careful attention.

While this subject has been left until the last in relative importance, it should receive first consideration by all wire rope users, master mechanics and engineers. In going around the country and inspecting various wire rope installations, it is a matter of frequent comment that some rope users who should be up-to-date, are using the poorest and least efficient methods of fastening the ends of rope. The idea is prevalent almost universally, that a clamp or clip, the gripping power of which is seen, is the most efficient fastening on the end of a wire rope. Notwithstanding this very prevalent opinion, the facts of the case are that clips and clamps are the least satisfactory rope fastenings that can be used. In order that this statement may not be misunderstood, in case there are some present who have held this opinion, I will give briefly the reasons for this statement based upon practical results and tests of various types of rope fastenings.

Rope Fastenings

In the first place, it will be conceded that a wire rope clip or clamp depends for its efficiency upon the tightness with which the nuts and bolts are drawn. That being the case, any rope fastening employing clips or clamps is dependent upon whether the operator tightens all the nuts sufficiently. If this were the only difficulty in the use of clamps or clips, it could perhaps be overcome without too much trouble. On the other hand there is a characteristic of wire rope

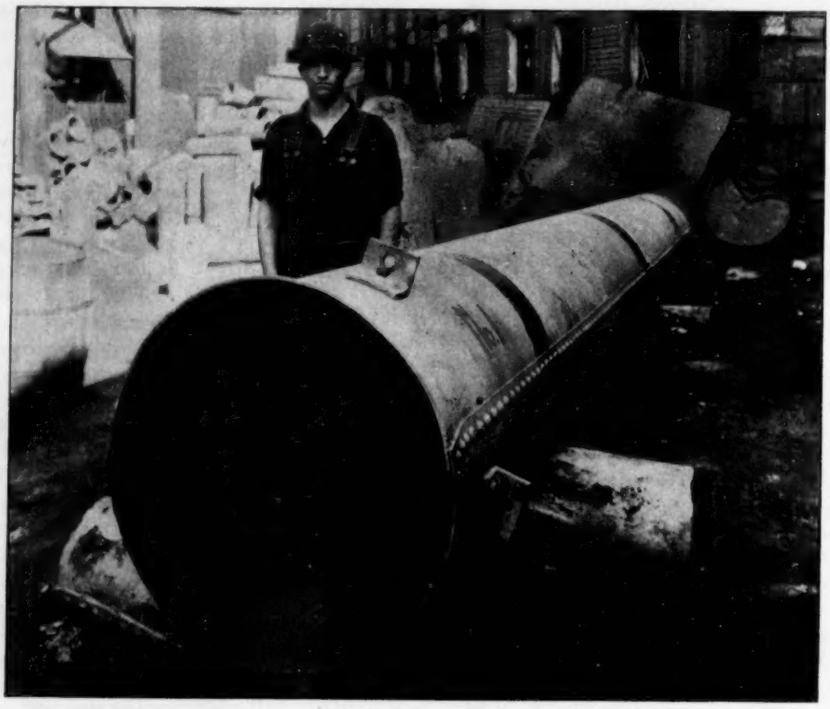
which upsets to a greater or lesser extent, the results of even careful fastenings of clamps and clips. A wire rope is not like a solid bar of iron. It is more or less yielding under compression, like a chunk of vulcanized rubber. No matter how tight the nuts are turned, it will be found a day or two later they can be turned up again with comparative ease. The reason for this is that the hemp center and rope strands when first compressed do not yield all at once, and the subsequent yield reduces the tension on the nuts and bolts. This of itself is a dangerous condition.

Furthermore, when a new rope is put on and clamps or clips are fastened up, it is usually done without any load on the rope. When the load comes on the rope there is a subsequent stretch and reduction in diameter of the rope incident thereto, which further decreases the value of the clamps and clips as regards holding power. Both of these features already enumerated are very bad in that the amount that the holding power is reduced cannot be definitely known without making an actual test. You will be interested to know that it is next to impossible to put a specimen of wire rope in a testing machine and put a load equal to more than two-thirds the breaking strength, without having the clamps or clips slip. If they are then tightened several times as the load is increased, it is possible to get an ultimate break of about 85 per cent with clips and 75 per cent with clamps. By this I mean that this is the best record that can be obtained with the clips or clamps as compared with the very best type of rope fastening. There are doubtless places where it is not possible to use other types of fastenings, and in such cases clips or clamps may be permissible, but it is my opinion that the field for clips and clamps is more for temporary fastenings than for permanent work. Where permanent fastenings are required something more efficient and certain should be used.

There are two types of fastenings, both of which are superior to clamps. A thimble or eye splice in the end of a rope can be depended upon to give 90 per cent of the breaking strength of the rope and is not dependent upon the tightness of bolts or nuts to insure its strength. A splice is made by a man more or less of an expert, who understands putting an eye into a rope. The heavier the load the tighter the eye splice will hold up to its capacity.

The best type of fastening, however, is what is known as the wire rope socket of open or closed type. When applied according to the best methods a wire rope socket can be depended upon to give 100 per cent efficiency, that is, if we have a rope with a breaking strength of 50 tons and we apply a wire rope socket, we can get a break of 50 tons in the testing machine. If we use an eye spliced in, we can get a break of 45 tons. If we use clips and tighten them up during the test, we can get 42 tons. If we use clamps, we can get about 38 tons. Just as true as the fact that a chain is no stronger than its weakest link, so is a wire rope installation no stronger than the fastening applied to its end. This is a fact on which great emphasis should be placed. An example will make this perfectly

(*Continued on page* 1256*b*)



LONGEST AND LARGEST STEEL PIPE EVER HEAT TREATED

Interesting Job of Heat Treating

The Steel Improvement Co., Cleveland, has just completed heat treating four large 21-foot steel pipes. It is said to be the first time that material of this length and size has been heat treated and the job presented an unusual number of difficult problems which the engineers of the Steel Improvement Co. successfully solved. One of the heat treated pipes is shown in the accompanying illustration. The pipes were special analysis steel, containing 0.70 per cent carbon. They were designed for service in the reduction works of the Aluminum Co. of America, at Massena Springs, N. Y. The pipes were fabricated by the Riter-Conley Mfg. Co., Pittsburgh. Each pipe was 21 feet long, 24 inches in diameter and had ⅜-inch walls. They weighed 2,000 pounds apiece. The furnace, in which the pipes were treated, is 22 feet long, 6 feet wide and is 4 feet high at the door. Owing to their length it was necessary to handle each pipe separately. The temperature in the furnace was brought up beyond the recalesence point, being maintained at an average of 1,525 degrees Fahr. This temperature was held for about 30 minutes. The pipes were then withdrawn and quenched in water. Accurate pyrometric control was of course maintained at all times. The heat treating of these pipes was undertaken as an experiment, but the results obtained were so successful that a 100 per cent increase in the life of the pipes is expected. Unusual wearing properties are required to resist the abrasive action of the material handled at the reduction works.

The Waltham Watch Co., Waltham, Mass., has secured a war order calling for the immediate manufacture of 2,000,000 units for time fuses.

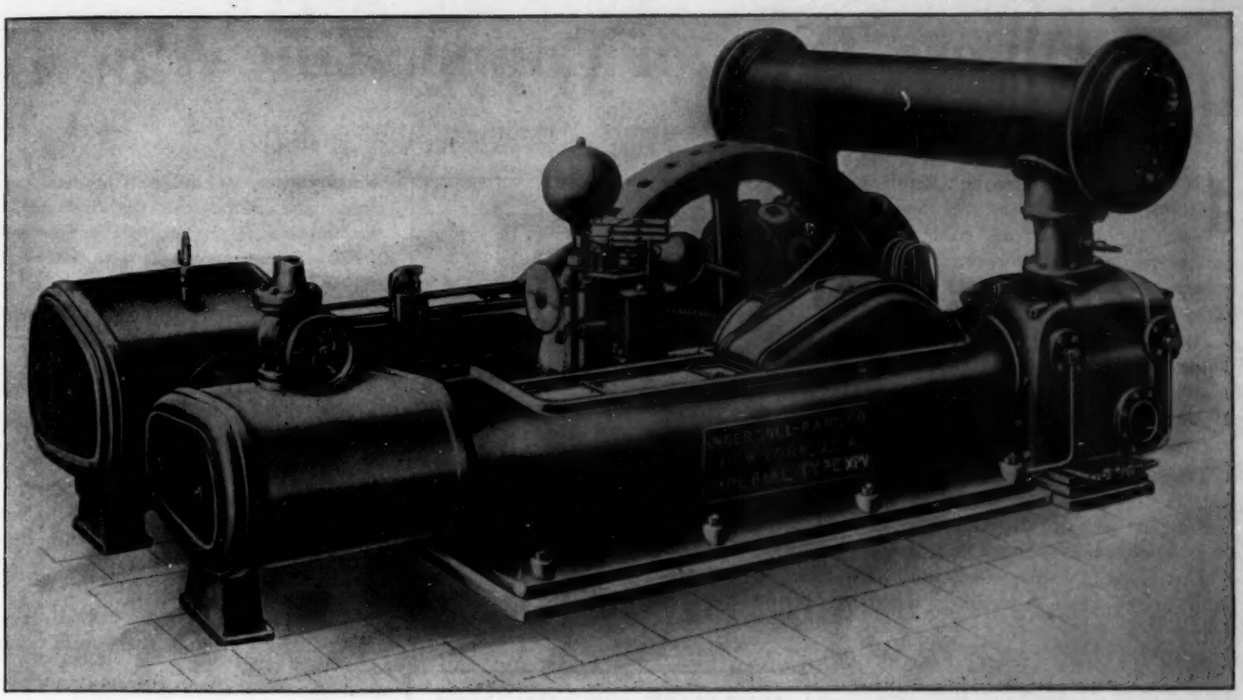


Fig. 1—Steam-Driven Air Compressor Equipped With Balanced Valve

A High Pressure Steam Air Compressor

A STEAM - DRIVEN air compressor, which is designed to operate satisfactorily under high pressures and superheat, as well as at more moderate pressures, has been brought out by the Ingersoll-Rand Co., New York. This machine is equipped with a balanced piston steam valve and valve gear. The new type of compressor is shown in Fig. 1.

Through the use of a balanced valve, it is possible to control this machine by automatically varying the point of cut-off in the steam cylinders. This method of regulation maintains a constant speed for changing steam pressure and at the same time varies the speed of operation to the demand for air. The automatic cut-off regulation is claimed to result in a considerable saving in the actual consumption of steam. The piston valve is a balanced valve of the telescopic type. The cut-off valves are right and left hand threaded to a cut-off valve stem. The steam is admitted through the center of the valve, passing then through the various ports to the cylinder and being exhausted by the ends of the valve. This construction exposes the valve chest covers and steam packings to exhaust pressure only and reduces the liability of leakage. The design of this valve is claimed to preclude any possibility of warping. The valve is said to be so balanced that the friction is minimized and lubrication facilitated.

The steam ports are large and unusually direct. A special effort was made to reduce the condensation surfaces in the cylinders. Steam economy is said to be promoted by the complete insulation, the separation of live and exhaust steam passages, and by the fact that the steam chest partially encircles the cylinder. This arrangement is shown clearly in Fig. 3.

The steam receiver is a direct connection between the high and low pressure steam chests. The low pressure chest is proportioned to furnish additional capacity. Its location permits the heat to be used in heating the cylinder and valve instead of being lost by radiation. Cylinder alignment is maintained by a special expansion joint. The governor is a speed and pressure regulator which varies the cut-off by automatically rotating the cut-off valve stem and changing the relative position of the cut-off valves. Essentially it is a chain-driven rotary oil pump, acting against a weighted plunger. The variation in oil pressure, due to the changing speed of the compressor, or in the air pressure through the movement of the plunger, changes the cut-off point in the steam cylinders. This governor is claimed to be entirely automatic in operation. Lubrication of both air and steam cylinders and valves is secured through force feed oilers. The other features include completely enclosed main frames containing the reciprocating parts, automatic lubrication by the bath system and water jacketed air compressing cylinders. The new compressor is built in capacities from 608 to 3,620 cubic feet per minute and for discharge air pressures from 10 to 110 pounds per square inch.

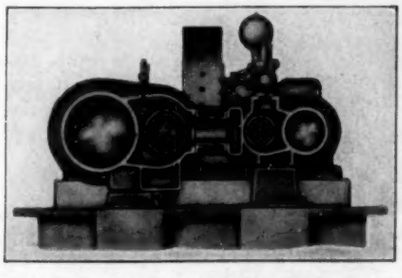


FIG. 2—SECTION SHOWING CYLINDER VALVES AND STEAM RECEIVER

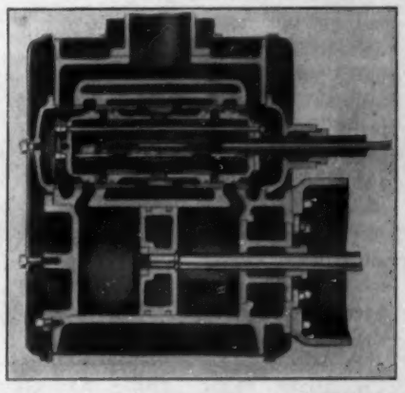


FIG. 3—SECTION THROUGH HIGH PRESSURE STEAM CYLINDER

Hardness Tests of Copper-Zinc Alloys

By Domenico Meneghini

IN ORDER to make determinations of hardness for ascertaining the extent of cold working or of incomplete annealing, and being unable to utilize the classic method of Brinell, it occurred to the author to use a little apparatus operating under a slight pressure exercised by a ball of small diameter. Fig. 1 shows sufficiently clearly the arrangement of the apparatus.

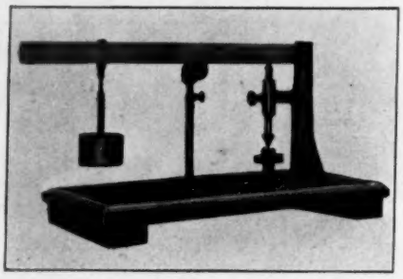


FIG. 1—INSTRUMENT FOR MAKING BRASS HARDNESS TESTS

The pressure is brought to bear on the small piece of the alloy, which has plane and parallel surfaces, by a lever along which weights can be moved. The steel ball, which will leave an imprint in the alloy, is fixed in a bronze cone.

The specimen under examination must first of all be polished, and the imprint subsequently made by the pressure of the ball is afterwards measured under the microscope by means of a magnifying micrometer. For checking this apparatus, and for seeing if the superficial hardness had values comparable with those obtained from the apparatus of Brinell or of Shore, the author determined the hardness of the copper-zinc alloys, of which there is in existence a complete diagram, given by Turner and Murray, obtained with the Brinell and Shore apparatuses. The speciments were perfectly annealed, were then cut in pieces of about 70 millimeters in thickness.

It was found that the alloys with zinc between 55 and 68 per cent were very hard and brittle, being most difficult to work. Those containing 78 to 88 per cent of zinc were in places very porous, and only in the case of samples containing 84 to 87 per cent of zinc was it found possible to obtain a specimen sufficiently homogeneous for making a hardness determination. The results are given in the accompanying table.

The determinations were made with a ball pressure of 10,870 kilograms (the diameter of the ball being 2.9 millimeters) in order to give an imprint lying between 0.280 millimeter and 0.570 millimeter. The superficial hardness is expressed as the ratio between the pressure exercised and the measured diameter of the imprint. For very hard alloys it was necessary to increase the pressure in order to obtain imprints lying between the values mentioned. In order to have all the hardness values stated for the same pressure, there were made for these very hard alloys three series of measurements at different higher pressures, and afterwards the diameter of the imprint at the normal pressure of 10,870 kilograms was worked out graphically. The diagram of superficial hardness is quite analogous to that given by Turner and Murray, only the first part of the diagram—that for brasses rich in copper—is less sinuous; perhaps than is due to the more perfect annealing of the specimens employed. It appears then that this very simple determination of superficial hardness can give in practice good results, which seem quite comparable with those obtainable with the much more costly apparatus, of Brinell and of Shore. This method has been utilized since for the study of gold-manganese alloys with very good results.

RESULTS OF HARDNESS EXPERIMENTS ON COPPER-ZINC ALLOYS

No.	Copper per cent	Zinc per cent	Diameter of Impression, Millimeters	Hardness $\delta = \frac{P}{d}$ †
1	100.00	.....	0.560	19.4
2	94.15	5.85	0.522	21.8
3	87.17	12.83	0.495	22.0
4	79.81	20.19	0.492	22.1
5	77.80	22.20	0.462	23.5
6	75.20	24.80	0.482	22.5
7	70.05	29.95	0.511	21.3
8	67.31	32.69	0.513	21.2
9	64.50	35.50	0.516	21.0
10	63.82	36.18	0.533	20.4
11	60.48	39.52	0.492	22.1
12	59.23	40.77	0.456	23.8
13	54.45	45.55	0.389	27.9
14	51.89	48.11	0.380	28.6
15	49.54	50.46	0.361	30.1
16	45.20	54.80	0.247	44.0
17	42.51	57.49	0.162	67.0
18	33.65	66.35	0.150	72.5
19	29.19	70.61	0.250	42.0
20	27.54	72.46	0.290	38.0
21	25.84	74.16	0.296	36.8
22	22.85	77.15	0.365	29.7
23	22.05	77.95	0.386	28.2
24	15.13	84.87	0.454	24.0
25	9.63	90.37	0.437	24.9
26	8.33	91.67	0.447	24.3
27	4.25	95.75	0.456	23.8
28	3.60	96.40	0.465	23.4
29	....	100.00	0.685	15.9

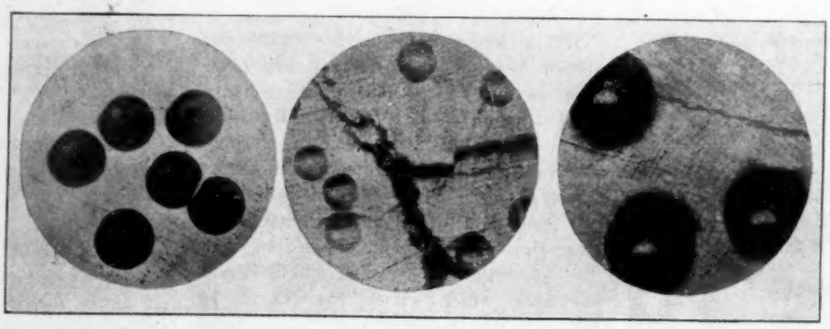


FIG. 2—HARDNESS IMPRESSIONS IN BRITTLE SPECIMENS OF THE SAME BRASS

The first specimen shows impressions in a sound portion. The second is a brittle fragment, and the hardness impressions are extremely irregular near the cracks. The third shows impressions after annealing, with a considerable dimunition of hardness. All are magnified 50 diameters. Their copper content is 64.1 per cent.

From a paper read at the September meeting of the British Institute of Metals.

Transvaal Steel Plants

For two or three years certain steel products especially designed for use by mines and railways, including bars of all sections, fencing standards, and light rails, have been manufactured in a modest way in the Transvaal. The material used is altogether scrap iron and steel, of which there is a large accumulation in the country, principally acquired from the South African railways. The two companies in the Transvaal now manufacturing these steel products are the Union Steel Corporation of South Africa, Vereeniging, and the Danswart Iron & Steel Works, Ltd., Danswart, near Johannesburg, both of which seem to find a good market for their output, which, of course, is relatively small. It has been decided to put the Union Steel Corporation on a sounder commercial basis in order to acquire further plants and machinery. These additions will include a 15-inch mill, a 22-inch cogging mill, and additional melting and reheating furnaces. At present the capacity of the plant is restricted by the sluggish working of the hydraulic press which presses and cuts the ingots into bars. When the large cogging mill starts work, these delays will cease. With the new plant it is hoped to roll up to 35 pounds and produce about 10,000 tons annually. Equipment for making bolts, nuts and rivets is being started.

Business News of Nation's Capital

Bills to Nationalize Industries Not Proving Popular— Redfield's Various Propositions

THE numerous bills and resolutions introduced in congress to "nationalize" all manufactures of war material and to place heavy internal taxes on munitions have created more or less interest. Developments are lacking, however, to lead to the belief that the former plan will be given any serious consideration, while the proposal to tax the manufacture of war munitions has given quite a little thought and has attained a fair degree of popularity among a number of members of congress. The effort to define war munitions continues to prove a difficult problem, and it is questionable whether the administration is at present supporting the plan to tax such products because of the difficulty mentioned. The proposed taxes pointed out by President Wilson in his address to congress have been accepted as a substitute for the plan to tax the manufacturers of war munitions. Yet, if a specific way in which to do the latter is found, it would not be surprising to see the administration urge such a scheme. Until the house ways and means committee takes up the taxation problem, the course that will be recommended to congress can be conjectured only. It is a foregone conclusion that a strong fight will be made against tax proposals suggested by the President and leading in the opposition will be those who will protest against the unjust tax of 25 cents per ton proposed on pig iron and a like tax on "fabricated steel". Hope is entertained by those who will assail such a tax on the iron and steel industry that the amounts named will be reduced at least and taxes shared by other articles, such as cotton.

None of the bills or resolutions proposing to "nationalize" the manufacture of war material or to tax the manufacture of war munitions is thought to have been given approval by the administration. Some of them, though, have been introduced by prominent Democrats who are in fairly close touch with the administration. A number of Republicans have also introduced bills and resolutions along the same lines.

War Tax Debate

The virtual ease with which the administration jammed through the resolution in the house continuing the present "war tax" until Dec. 31, 1916, has apparently given confidence that it will be able to put through supplementary taxation legislation without a great deal of trouble. While this may be true, the program suggested by the administration may have to be revised. In the senate, at least, assurance is given of a heated fight. The sharp encounter made in that body on continuing the present war tax is evidence of what is to come. In both the house and the senate, Republicans attacked the plan to re-enact the measure, and asserted that it would not be necessary were it not for the insufficiency of the Underwood-Simmons tariff.

In his report made public last Friday, Secretary of Commerce William C. Redfield said that he would prefer that the competitive conditions after the war should be dealt with by a method other than tariffs, "classing it rather as an offense similar to the unfair domestic competition we now forbid." His opposition to upward tariff revision was not unexpected, while the proposed anti-dumping legislation which he recommended was also anticipated in view of principles he has enunciated from time to time recently. His declaration that while "unfair competition is forbidden by law in domestic trade and the federal trade commission exists to determine the facts and take steps to abate the evil wherever found, was followed by the admission that "the door is still open to unfair competition from abroad which may seriously affect American industries for the worse". Pointing out that "It is a destructive type of the industrial struggle, intended to put out of being the forces opposed to it that the victor may exploit the field at will," Mr. Redfield says it seems possible that by using the existing machinery of the treasury department and the department of justice, "we may restrain this foreign 'unfair competition' on both sides of the sea." He then recommends legislation giving foreign representatives of the two departments the proper added power and increased personnel and evidently means that officials of the treasury department would gather facts as to the market prices of materials in the country of production and report them to collectors of customs so that the latter could prevent the products from being "dumped" in this country at a price less than that prevailing where they originate and the department of justice, apparently, would be authorized to prosecute those who engaged in the practice. In suggesting such legislation, he says he would recommend that it be enacted "if possible", and would also make it the law that the American markets would be forfeited to those dumping goods in this country.

The Redfield Bill

The secretary's recommendation of legislation supplemental to the Clayton anti-trust act making it unlawful to sell or purchase articles of foreign origin when prices to be paid are materially below the current prices in the country of production and when such prices tend to create a monopoly or lessen competition, is in line with the bill he has submitted to Majority Leader Kitchin of the house, provisions of which have been published in *The Iron Trade Review*. While his proposal to prevent dumping has been taken to be to the interest of American manufacturers, the argument has been made at the same time that it is involved, if not impossible of enactment into law. Those who have objected to it on this ground have explained that the simplest, as well as the best way, to solve the entire problem is to give American manufacturers higher tariff protection.

Mr. Redfield also recommends legislation permitting American manufacturers to form export combinations and allowing American banks to cooperate in establishing foreign branches or in owning stocks of banks operating in foreign countries.

Discussing the work of the bureau of foreign and domestic commerce, he recommends re-establishment of the service allowing collection of statistics of internal commerce, so that they may be made known to business interests. He would also increase the working force of the bureau as well as add 10 commercial attaches to the 10 now employed by the bureau. He would have one each appointed to the Scandinavian countries, Japan, Holland, the Dutch colonial empire in the far east, India, South Africa in the near east, including Egypt, Persia, Asia Minor, Greece, Roumania and

other Balkan states, Central America, Venezuela and Colombia.

Mr. Redfield has made public tables supplementary to the detailed statistics in the annual report of the commissioner of navigation for the fiscal year ended June 30, 1915, bringing down to Dec. 1 the figures of the United States merchant marine and of the vessels being constructed or under contract to be built in American ship yards, aggregating 761,511 gross tons.

Armor Plate Awards

Washington, Dec. 21.—The navy department awarded armor tonnages the latter part of last week for battleships Nos. 43 and 44. Of the four classes, the Carnegie Steel Co. received awards for three, A-1, calling for 14,779.2 tons, at $425 per ton; A-2, 820 tons, at $486 per ton, and B, 602 tons, at $460 per ton, the total of the contract aggregating $6,956,557.50. The remaining class, C, bolts, involving 120, went to the Midvale Steel & Ordnance Co., and the Bethlehem Steel Co., each getting 60 tons, the former at $376 per ton and the latter at $395 per ton, their contracts amounting to $45,760, making the entire amount of all awards $7,002,317.50. The Carnegie company had previously received awards amounting to $1,680,777.70 for structural material for the two ships, the total value of its contracts amounting to $8,637,335.20.

Arbitration Tribunal

Washington, Dec. 21.—Representative Foss, of Illinois, has introduced a bill in the house to create a national arbitration tribunal and to define its duties and powers. The tribunal would consist of six members, one of whom as member ex-officio would be the secretary of labor, the others to be appointed by the President and confirmed by the senate. Each member except the secretary of labor would receive an annual salary of $8,000, terms of office ranging from two to six years.

Mining Law Revision

Washington, Dec. 21.—Revision of the present mining laws is proposed in bills introduced in the house the past week. One was introduced by Representative Taylor, of Colorado, and another by Representative Raker, of California. Each provides for appointment of a commission to codify and suggest amendments to the general mining laws.

Secretary Franklin K. Lane, of the interior department, in an address last week before a meeting of the Mining and Metallurgical Society of America, at the New National Museum in Washington, said he had given his endorsement for the revision of the present mining laws and expressed hope for the support of the mining men in congress. The meeting of the society was called for the purpose of urging a revision of the laws.

Estimated Revenue

Washington, Dec. 21.—Responding to a resolution introduced by Senator Gore, regarding the estimated revenue should taxes be laid upon tea and automobiles and readjusted on sugar, Secretary of the Treasury McAdoo has submitted the following report:

A duty of 10 cents per pound on tea would yield $9,412,901; 1.5 cents per pound on sugar, $74,001,990, less 20 per cent on Cuban sugar, $60,946,000; an excise tax of 1 cent per pound on sugar produced in the United States and its possessions, $41,373,733; 25 cents per horsepower on automobiles, to be paid by manufacturers, $5,250,000.

Will Encourage Manufacturing

Ten manufacturers engaged in machinery lines in Hartford, Conn., compose a group which is behind the Hartford Factory Owners, Inc., a new $100,000 Connecticut corporation organized for the purpose of holding the old Billings & Spencer Co. plant in that city with a view to the encouragement of manufacturing in Hartford by leasing or renting to manufacturers outside the group and also to provide for an overflow in case of expansion of any one of the plants of the 10 manufacturers forming the group. The group is made up of the Pratt & Whitney Co., Whitney Co., Whitney Mfg. Co., Underwood Typewriter Co., Hartford Rubber Works Co., Taylor & Fenn Co., Hartford Machine Screw Co., Sigourney Tool Co., Hart & Hegeman Mfg. Co., Colt's Patent Fire Arms Mfg. Co. and the Royal Typewriter Co. The new corporation paid $150,000 for the Billings & Spencer Co. property, which is about $10,000 less than the assessed valuation, but the $160,000 represents the dozen buildings with their contents when the plant was in operation. Of the $150,000, $50,000 was paid in cash and $100,000 remains on a mortgage.

The Aluminum Holloware Co., Marion, Ind., has changed its name to the Marion Brass Foundry Co.

Building a New Shaft

Completion of a new shaft at the Washington iron mine of the Empire Steel & Iron Co., at Oxford, N. J., is being pushed forward rapidly at present and a depth of about 700 feet on the incline now has been reached. It will be necessary to sink the shaft about 300 feet further to reach the present lower workings. The work was started about three months ago. New equipment for the shaft has been ordered from the Wellman-Seaver-Morgan Co. and from the Allis-Chalmers Mfg. Co. By April 1, it is expected that both the new shaft and a modern magnetic separation plant replacing the present unit of this type will be in operation. The improvements will increase the output of the Washington mine about 50 per cent. The Empire Steel & Iron Co. at the present time is shipping from its Oxford and Mt. Hope mines about 30,000 tons of ore averaging approximately 60 per cent in metallic iron.

Steel Battleplane Tested

The first new steel battleplane made by the Sturtevant Aeroplane Co., Readville, Mass., was successfully tested in that place for the United States army, recently. The flights were made by Lieut. Byron Q. Jones, of the United States army aviation corps, and culminated with a loop-the-loop sideways, a feat never before attempted in this country and performed abroad but infrequently. Previously Lieut. Jones had tried out the aeroplane in every conceivable way, by stalling the engine while in the air, diving steeply to the ground, and making the sharpest of banks on the turns. The aeroplane was designed by Grover C. Loening, vice president and designer of the company, of which Noble Foss is president. It is a bi-plane of the tractor type, with a torpedo body and is built to mount two guns for offensive and defensive purposes. The spars and struts throughout are constructed of vanadium steel, and the power plant consists of a 140-horsepower Sturtevant engine, of the type shipped abroad in large quantities to Great Britain and other of the entente allies.

The Volunteer State Life Insurance Co., of Chattanooga, Tenn., has secured permission from the courts to erect an office building, and Barnwell & Barnwell, Chattanooga architects, have been appointed to draw the plans. A 10-story steel frame building to cost about $150,000, will be erected.

News of Employers and Employes

All But One of 90 Strikes in Connecticut Settled—Massachusetts Board of Arbitration Makes Award

CHRISTMAS week finds the strike situation in New England at a standstill and no developments either way are expected until after the holidays. An interesting piece of news comes from the office of William S. Hyde, the state labor commissioner of Connecticut, in Hartford, that there have been about 90 strikes in the state since the beginning of the recent series of labor troubles and of these practically all have been settled except that of the International Silver Co., Meriden. Although there is discontent among the machinists in Bridgeport, it is understood that there are no labor disturbances there at present. The commissioner says that the strike at the Pratt & Whitney Co. factory in Hartford is ended and that strike-breakers put an end to a strike in New Haven that at one time looked serious.

Officials of the Hartford machinists' union say there is no truth in the report as far as the Pratt & Whitney Co. is concerned, as the strike there is still on in full force and pickets are doing duty at its gates every morning. They further say that 1,700 are at work now instead of 3,200 as claimed by the company at the time of the strike.

Another little strike in Hartford is at the National Iron Works, 25 employes being out, but just what they are striking for the men appear to be a bit uncertain.

The Massachusetts state board of conciliation and arbitration has awarded to the machinists in the employ of the Ludlow Mfg. Co. Associates, Ludlow, Mass., an increase of $2.43 in weekly wages. The award follows an investigation and hearing by the state board and experts selected by the company and the machinists' union of demands by the employes of the shop and repair department for an increase of approximately 25 per cent. The award amounts to about 15 per cent of the wages now received by the men. The other concessions sought by the men were granted by the company without submitting them to arbitration. Under the agreement, the men will now receive an increase in wages equivalent to 15 per cent, time and a quarter for overtime and will work a 54-hour schedule. The original demands were for a 48-hour week, time and half-time for overtime and double time for holiday and Sunday work.

The Scovill Mfg. Co., Waterbury, Ct., announces the payment of a 10 per cent bonus, based on annual salary, to all its salaried employes. The number is several hundred. Some time ago, the company increased the wages of its employes on piece work and day wages 10 per cent.

The Derby Silver Co., Shelton, Ct., a branch of the International Silver Co., employing about 225 hands, has posted notice that, effective Jan. 1, the shop will run on a 56-hour weekly schedule. Day workers will get pay for 60 hours and piece workers will receive a 10 per cent increase.

According to the officials of the machinists' union of Springfield, Mass., about 800 machinists have left that city within the past three months to take employment in the plants of the Remington Arms Co., in Eddystone, Pa., and Bridgeport, Ct. Of this number, about 500 went to Bridgeport, taking their families with them. The majority of these men, who are highly skilled mechanics and commanded some of the best positions of their craft in Springfield, went to these plants under two-year contracts with a guarantee of at least $1,404 a year. A 55-hour week is provided for in the agreement and the contract becomes operative when it is signed.

New Pension Plan

Landers, Frary & Clark, New Britain, Ct., have decided to establish a pension system to become operative Jan. 1. Male employes who have been with the company 25 years or over will be retired at the age of 70. Female employes, in service a similar length of time, will be retired at the age of 60. A pension board of three members will have charge of the administration of the system. To be eligible for pension, employes must become members of the Landers, Frary and Clark Mutual Aid Association by March 1, 1916, and remain a member of the same in good standing. No pension shall become operative until after the payment of all sick benefits the pensioner may be entitled to receive shall have ceased. Every male employe as specified above shall be retired at the age of 70 and receive pension unless at his request and with the approval of the pension board some later date for retirement is fixed. Female employes shall be retired in the same manner at the age of 60. An employe who has been 20 or more years in the service and has become permanently incapaciated for further work, may at the discretion of the pension board receive a pension. Any male employe from 65 to 69 years of age 25 years or more in the service of the company who has become incapacitated for work may make application or be recommended for retirement and the pension board shall decide on his case. The same applies to any female employe from 55 to 59 years of age. The amount of pensions shall equal 1 per cent of the average yearly wage for 10 years prior to retirement times the number of years employed, but such pension shall not be less than $250 or more than $1,000 per year.

Yearly Contracts

About 60 machinists have left Hartford, Ct., for Eddystone, Pa., where they are to be employed by the Remington Arms Co., 10 hours a day except Saturday, at the rate of $1,404 a year. They signed contracts under which they are employed until July 1, 1917, and which allow them the difference between the wages they make in Hartford and the wages which they will earn in Pennsylvania during the time they are waiting for orders to report on their new jobs. This money is to be paid one month after reporting for work. Other contracts with expert machinists and tool makers have been made at figures varying from $1,560 to $1,760 a year. All of the contracts are for one year. Since the contracts were made Oct. 27, the Remington company has been ordering its workmen to report, a few at a time, as machinery was prepared for them to use. The work on which the Remington works in Eddystone is busy is said by the men who are going there to work to be an order for 2,000,000 rifles for Great Britain.

An agent from the Ross rifle works, Quebec, Can., has been in New England this month offering attractive wages to skilled mechanics to go there. The company not only

offers to pay transportation to and from Canada on a six months' contract, but agrees to pay 60 cents an hour in wages with a 10 per cent bonus at the end of six months. The offer was so attractive that about 15 Springfield, Mass., men signed with the Canadian concern.

Westinghouse Strike

About 500 machinists and tool makers employed at two of the four plants of the New England Westinghouse Co., in Springfield and Chicopee Falls, Mass., went on strike Dec. 18, demanding the reinstatement of the union's shop steward, who was discharged Dec. 16, an increase in wages and recognition of the union through representation on the shop committee. There was no violence or excitement accompanying the walkout. The river plant at Chicopee Falls, where the entire force of 400 men walked out at 9 a. m., was picketed that night. Union officials say that unless an agreement is reached this week the three remaining Westinghouse plants, employing about 1,600 men will be "pulled", and efforts will be made to stop the manufacture in other factories of machinery for Westinghouse use. They say the men want minimum wages of 60 cents an hour for gage makers, 50 cents for tool makers and 45 cents for machinists. The departure of Vice President L. A. Osborne for New York has started the report that strike breakers are to be imported. The company employs about 2,000 men and holds a big contract for the manufacture of rifles for the Russian government.

Extravagance of Workmen During War

Office of *The Iron Trade Review*,
Prince's Chambers, Corporation St.,
Birmingham, Eng., Dec. 13.

We have reached apparently another of those lulls in the war which have generally been the prelude to increased vigor, in one direction or the other. If this does not recur, it will be because the conditions in the fighting areas are rapidly rendering warfare impossible. Our soldiers returning from France give rather dismal accounts of the weather conditions there, with abundance of rain and fog, and a super-abundance of mud. Some of the soldiers say that it is impossible for men to move without getting knee deep in mud, while the movements of guns are all but impracticable. All that we know is, that recruiting goes on at a greater pace than ever.

The matter most concerning us at the moment is the one of finance, and no doubt you will have seen a report of the remarkable meeting between the premier, the home secretary and the president of the board of trade at a great conference representing 4,000,000 trade unionists at the special invitation of the latter, they delivered addresses. The ground of Mr. Asquith's appeal was that the workpeople should so deal with their exceptional earnings as to leave the largest possible surplus available for the war chest. It is notorious that the capitalists are contributing a far heavier ratio of their gains than the workpeople, and every day we are hearing extraordinary stories of the extravagance of workpeople. Among Mr. Asquith's appeals was one to the trade unions to discourage workpeople from demanding higher wages. This rather suggests a lecture to a den of lions on the merits of vegetarianism, and the workpeople are not inclined to take it very seriously. It is a fact that matters have been much more peaceable lately than they were in the earlier days of the war. The earnings of some of the workpeople, however, are extravagant, almost beyond belief and they are scattering their money right and left.

Blames Company

Julius C. Stremlau, Meriden, Ct., president of the Connecticut state federation of labor, places the blame for the recent strikers' riot at Factory H, of the International Silver Co., in Meriden, upon the company because it did not notify the police there that it was going to bring in "strike-breakers" and because there was, therefore, not sufficient police protection at the factory when the riot resulted from bringing in, in the early morning, men to take the places of the strikers. Eleven of the employes who took part in the riot, Nov. 14, have been allowed to go on payment of $50 and costs each. In the police court the sentence in each case was 60 days in jail and costs.

War Bonus

The November war bonus of the Reed-Prentice Co., Worcester, Mass., paid Dec. 1, amounted to nearly $10,000 and was distributed among about 700 employes. It was the third bonus that the company has paid and has been increased about $1,000 a month, in spite of the fact that there is a strike on at the plant. Though between 800 and 900 employes walked out Sept. 20, many have returned and these with new men who have been hired in Worcester and elsewhere brings the total to about 700, exclusive of the clerical forces. This is not sufficient to warrant the company returning to night work at present, but if the force increases at the rate of 200 a month as it did last month, it will be done early in the new year. The company has about $3,000,000 worth of unfilled orders and wants to operate to capacity. At present, 450 men are employed in the machine shops departments.

Court of Arbitration

A building trades court of arbitration in which contractors, as well as employes, may submit difficulties and through which strikes will be avoided will likely be established in Detroit as a result of an investigation conducted by the Builders' and Traders' Exchange into conditions in Chicago.

The plan is to have this arbitration board open to open, closed or non-union shops and to have it supported by the building contractors who will pay one-tenth of one per cent of their gross earnings each year.

A committee will go further into the proposition.

Right now such an arbitration court should prove indispensible to the builders of Detroit. Recent announcements call for the construction of a number of large buildings in the downtown district. The Statler Hotel Co., will construct a 15-story addition to its new hotel on Washington boulevard while a new corporation known as the Tavern Hotel Co., will erect a 14-story hostelry.

The Remington Arms & Ammunition Co.—Union Metallic Cartridge Co., Bridgeport, Ct., have agents canvassing the city and suburbs to find rooms for operatives pending the construction of the $500,000 Remington city on the east side of Bridgeport. In the meantime some of the workmen who have been brought in from other cities are sleeping on the benches at the factories of the local arms companies, and in hotels, which are taxed to capacity.

The Bunting Brass & Bronze Co., Toledo, reports a fine business and the finishing department is finding it necessary to run 24 hours a day. The foundry is going full blast 16 hours a day. Shipments in October were the largest in the firm's history and the November business was even stronger. The Bunting Brass & Bronze Co.'s products are used by manufacturers of machine tools, automobiles and general machinery all over the country.

Billet Scarcity is Serious

Prices in England Very High and Great Difficulty is Experienced in Meeting Requirements

Office of *The Iron Trade Review*,
Prince's Chambers, Corporation St.,
Birmingham, Eng., Dec. 13.

VALUES of pig iron have increased decidedly on the week, although this condition is not fully reflected on the Glasgow market. A late quotation at Cleveland was 72s ($17.28) which is (24c) less than that of a few days ago. But this appears to be only a temporary condition, due to some profit-taking, after a sharp buying movement. The stocks in that district are slightly lower than they were, totaling 126,000 tons. The Midland markets are decidedly stronger. At the Birmingham meeting, recently, there was a greater anxiety by buyers to book further ahead. But they were somewhat staggered by the substantial advances demanded. Most brands, including Northampton, Derbyshire and Lincolnshire, were about 2s (48c) higher on the week, while some of the Staffordshire makers ran away with quotations from 8s (1.92) to 10s ($2.40) dearer than those of two to three weeks ago.

It is inevitable that prices must rise considerably. Coke has become almost unobtainable. Some buyers were running round the market trying to arrange parcels to keep furnaces in operation, but without success. Stories of inability to get coke and of furnaces going on slack blast for want of fuel, were quite monotonous. An important element must be a further rise in wages of 10 per cent, for furnace workers. Blast furnacemen are not under the wages board, but for some years past have voluntarily adopted its awards, whether in an upward or downward direction. Added to the difficulty arising from the scarcity of fuel, is the serious congestion on the railways, which makes it impossible for material to be got to and from the furnaces. The railways adopt almost a careless attitude, when appealed to, pointing out that as they are now controlled, their chief task must be to handle stuff connected with the war, while everything else is of secondary importance. What pig iron will be before the war is over, nobody can forecast. Hematites are rapidly rising in value, the northeastern quotation being 127s 6d ($30.60).

The week has been an eventful one in regard to all finished material. After much deliberation the makers of best iron have put up their prices from £12 10s ($60) to £13 10s ($64.80). This advance is several weeks overdue, and for some weeks past the makers without altering their published quotations have been adjusting matters by the imposition of a premium of £1 ($4.80) on nominal quotations. Common iron now has something like its proper relation to best iron as the relative prices are £12 10s ($60) and £13 10s (64.80). This is the seventh advance in best iron during the present year which commenced with the selling figure at £9 ($43.20). Naturally, the effect of the rise has been to stimulate the prices of common iron. But a more material influence arises from the advance of 10 per cent which comes to the workpeople under the bimonthly report just issued by the wages board. The returns for September and October show the remarkable rise in selling prices from £9 11s 2d ($45.88) to £10 8s 8d ($50.08).

The great feature of the finished trade is the scarcity of steel, which is more and more difficult to get. The government cannot get sufficient open hearth steel and at controlled works is authorizing the putting down of new furnaces. This scarcity cuts off all supplies of this material for ordinary commercial purposes, but bessemer also is very scarce, and the small quantities available are being sold at prices ranging from £11 ($52.80) to £13 ($62.40) per ton. In the Sheffield district, basic billets are £12 ($57.60) to £12 10s ($60), while bessemer acid stands at £14 ($6960). Wire rods are almost impossible to get. A few small lots are coming from America on old contracts; but when these run out, early in the New Year, consumers are not hopeful of renewal and have almost given up expecting any. It is clear that some rolling mills dependent on outside billets must shortly come to a standstill. Remarkable prices are being obtained for finished steel, as much as £17 10s ($84) having been handed over for small bars.

Black sheets have advanced to £15 ($72) per ton and galvanized sheets to £24 10s ($117.60) per ton. The latter advance is in spite of a small reduction in spelter.

Orders have been pouring in to Sheffield, quite outstripping labor possibilities. Mechanics have recently been imported from Holland, Belgium, Denmark and Canada, and many more could be received. Some thousands of boys have been liberated from school at an earlier age than has been customary for some years past, and this, to some little extent, has relieved the pressure. Somewhat to the surprise of the iron and steel trade, the workpeople have acquiesced with a fairly good grace in the new drinking restrictions. But the cutting down of the liquor has been somewhat of a shock to Sheffielders, who have been running up drink bills ranging between 20s and 30s a week. The stopping of credit is very well commended.

Will Build Brass Rolling Mill

The erection of a brass rolling mill, which will be a new department in its business, has been inaugurated at the plant of the Quigley Furnace & Foundry Co., Springfield, Mass. The mill will consist of six stands of rolls and 80 fires, and it is expected that operations will be started in about 90 days. Already the company has booked large contracts for strip and other forms of rolled brass. It now is buying machinery for the new plant and still is in the market for considerable miscellaneous needs of this character. The Quigley Furnace & Foundry Co. at present is conducting a gray iron foundry and heating furnace manufacturing plant at Springfield. The offices of the company are at 105 West Fortieth street, New York City.

Will Resume.—The 22-inch mill of the Bay View (Milwaukee) plant of the Illinois Steel Co. is about to resume operations after being idle for several years. One shift a day will be put on in this department, and will require about 150 operatives.

The Norwich Housing Co., Norwich, Ct., has been incorporated under the laws of that state with a capital stock of $100,000 for the purpose of acquiring and holding real estate and the erection and remodeling of factories. The Hopkins & Allen Co., of that city, manufacturers of firearms, holds 195 shares of the stock or a controlling interest. The officers of the company are: President, W. F. Lester; vice president, D. T. Shea; treasurer, S. B. Palmer; secretary, J. J. Corkery, all of Norwich.

A small addition is to be constructed to the plant of the Indianapolis Drop Forge Co., Indianapolis.

Contracts for Ships

The Fore River Ship Building Corporation, Quincy, Mass., has signed contracts to construct three large steamers, two of them for Edgar F. Luckenbach, New York City, and one for the Argentine government, at a total cost of about $2,600,000. This makes the total number of merchant ships under contract at the Fore River yards 12, besides many submarines and larger warships for the United States government and for Spain. The two Luckenbach ships which have just been contracted for will cost about $1,000,000 each and are sisters of the two already under way. Each is 456 feet 5 inches long, 57 feet beam and has 41 feet 6 inches depth of hold. The third new ship, which is to be built for Argentina, will be purely of the merchant type for carrying fuel oil. She will be 330 feet long and her cost is, roughly, $600,000.

Visitors From France

Toronto, Dec. 22.—A deputation of prominent Frenchmen is coming to Canada to conduct an investigation as to purchases for the French government. Inquiries will be conducted at Toronto, Ottawa and Montreal, as to the cost of materials required, including transportation. It is expected that the investigation may result in the placing of further heavy orders with Canadian manufacturers. The first session of the commission will be held at Toronto.

Preparing to Expand

Toledo, Dec. 21.—The Toledo Furnace Co. was given permission by the public improvements committee of the city council to build a railroad track across Front, York, Craig and Genesee streets, Birmingham, to accommodate the company and also the Toledo Shipbuilding Co. and Marine Boiler Works. The request was made by the attorney of the Toledo Furnace Co., who stated that the desired permission would be the first step taken by his company to increase the capacity of its plant.

Tube Company Sold

Toledo, Dec. 21.—The Standard Steel Tube Co., at Detroit and Fitchland avenues, has changed hands, L. V. McKesson, president, and George L. McKesson, secretary, having sold their entire holdings. The purchasers are George B. Storer, formerly vice president and manager, and P. B. Chase, who divides his time between Sparta, O., and Washington, D. C. Mr. Storer is president and general manager of the new company. The plant employs 300 men and is said to have $600,000 worth of orders on its books. The business was established only eight years ago.

Associated for Common Good

Manufacturing interests in Massachusetts have formed a club under the name of "The associated industries of Massachusetts", one of the objects of which is to secure adequate protection against unfavorable legislation at future sessions of the great and general court, as the Massachusetts legislature is legally known. Among the machinery and machine tool makers whose names have been connected with the new enterprise are George S. Barton, president and treasurer of the Rice, Barton & Fales Machine & Iron Co., Worcester; Gifford K. Simonds, treasurer of the Simonds Mfg. Co., Fitchburg; Harry Fisk, of the Fisk Rubber Co., Chicopee Falls; A. W. Gilbert, of the Chapman Valve Co., Springfield; F. H. Payne, of the Greenfield Tap & Die Co., General Electric Co., Lynn, and others.

Record for Copper Production

All records for monthly production of copper in the Lake Superior district were shattered during November, during which practically every mine operated at capacity. Official figures on the several companies will not be available for some time, but from various sources it is learned that the output was nearly 26,000,000 pounds. It is not believed there will be any decrease during December and the prediction is being made that the grand total for the year will show 250,000,000 pounds of copper for the Keweenaw district and Ontonagon county.

Buys Automobile Company

Fisk Rubber Co., Chicopee Falls, Mass., has bought control of the Federal Rubber Mfg. Co., Cudahy, Wis., which owns the Federal Rubber Co., of Illinois, a sales corporation, and has an annual production of $6,000,000. The company is a $2,000,000 corporation making automobiles, motorcycles, bicycle and solid vehicle tires and mechanical rubber goods, and started in May, 1911. It will continue as a separate organization, specializing in developing the jobbing and mechanical lines. Byron C. Douse, president and general manager of the Federal Co., has disposed of his holdings and resigned his offices. The new officers are: President, H. T. Dunn, Toledo, O.; vice president and general manager, B. H. Pratt, Milwaukee, Wis.; assistant general manager, H. A. Githens, Milwaukee; treasurer, Harry G. Fisk, Springfield, Mass.; secretary and assistant treasurer, R. C. Ward, Milwaukee; controller, E. M. Bogardus, Springfield, Mass.

More Ford Plants

The Ford Motor Co., is adding three more links to its nation-wide chain of service and assembly plants located at important points throughout the country. The latest additions are for Milwaukee, Oklahoma City and Omaha. They will be ready for operation early in 1916 and the combined cost will be approximately $1,000,000.

The assembly plant at Milwaukee will have a capacity of 75 cars a day and will employ about 400 men. It will cost $375,000 and will be in operation Feb. 1. The Omaha plant will cost $375,000 and will employ 400 men with a capacity of 75 cars daily. The Oklahoma City plant will cost $230,000, will employ 300 men and will assemble 40 cars a day at the start, later increasing to 60 per day.

These new plants are designed according to the uniform plan adopted by the Ford company. They will bring the total number of assembly plants to 28.

Production of Iron Ore Last Year

The total production of ore in the United States in 1914, as shown by the report of the United States geological survey, was 41,439,761 tons, the tonnage being divided as follows: Northeastern states, 1,563,725; southeastern, 5,707,381; Lake Superior, 33,629,613; Mississippi valley, 37,904; Rocky Mountain, 499,856; Pacific slope, 1,282.

It is interesting to note that the shipments from the Lake Superior ranges in 1914 as compiled by *The Iron Trade Review* were 32,729,726 tons, or 899,887 tons less than the tonnage mined, thus indicating that the difference in the two tonnages was placed in stock piles. In 1913, the difference between production and shipments was even greater, the production being 52,518,158 tons, while the shipments were 49,947,116.

Iron and Money: Fact and Comment

English Mobilization of American Securities Has Some Effect on Market—No Real Cause for Anxiety

THE announcement of the plan of the English government to buy American securities and the very serious tone of the correspondence between the United States and Austria caused some anxiety in the stock market last week, but there was no decided movement either up or down.

Stocks dragged Monday and numerous losses of ½ to 2 points were recorded. New York Central stocks displayed considerable strength.

There was some irregularity Tuesday, but on the whole the market was stronger. Exchange on Germany made a new low record. News received by cable indicated that the English press generally approved the chancellor's scheme for mobilizing American securities, but one prominent paper predicted that the market would beat the government if it tried to buy securities. Sir George Paish gave out an interview in which he supported the government and paid a glowing tribute to the American markets, which, he said, would absorb the securities without any trouble.

The selling of Anglo-French bonds following the dissolution of the syndicate was blamed for the hesitation manifested Wednesday. Several noteworthy gains were recorded. Exchange on Berlin again went to a low record, as did also German, Austrian and Hungarian bonds.

The strained relations of this country with Austria had a depressing effect Thursday. Further weakness in German marks developed. The English chancellor of the exchequer stated officially that Canadian securities owned in England would be included in the mobilization scheme, as will South American securities carrying right of payment in the United States. The bank of England in its weekly statement reported a gold increase of $40,000.

The market opened Friday in a listless manner, but some gains were made later in the day. Baldwin Locomotive gave considerable evidence of strength. Foreign offerings of American securities were not so heavy. A slight improvement developed in Anglo-French bonds.

The half-day Saturday was marked by very little trading. Reports of clearing houses indicated that clearings for the week were 64 per cent in excess of the corresponding period last year and 39.6 per cent ahead of the same period in 1913.

Quotations at the close of business Dec. 18 and changes in the leading stocks identified with the iron and steel industry are shown in the following table:

	Close Dec. 18	Net Change
American Can	59½	— ½
American Can, prfd.	111	+ ¾
Amer. Car & Fdy. Co.	79	— ¾
Amer. Car. & Fdy. Co., prfd.	116	— ¼
American Locomotive	68½	— ½
American Locomotive, prfd.	102	+ ¼
American Steel Foundries	61½	— ⅜
Baldwin Locomotive	116¼	+2⅞
Baldwin Locomotive, prfd.	108½	+ ½
Bethlehem Steel	474	+1
Bethlehem Steel, prfd.	150	—5
Colorado Fuel & Iron	51½	+1⅜
Continental Can	84½	—1
Crucible Steel	72⅞	+ ⅝
Crucible Steel, prfd.	111¾	+1¾
General Electric	173⅜	+ ⅜
International Harv. of N. J.	110¾	+ ¼
Internat'l Harv. of N. J., prfd.	117½	—1
International Harv. Corp.	83	—1⅜
Internat'l Harv. Corp., prfd.	108	.....
Lackawanna Steel	81	.....
Nat'l Enamel'g & Stamp Co.	28¾	— ¼
Nat'l En. & St'mp. Co., prfd.	94⅜	— ⅜
Pressed Steel Car	64½	+1½
Pressed Steel Car, prfd.	105	+1½
Pullman Palace Car	165	.....
Republic Iron & Steel	54¾	+ ⅜
Republic Iron & Steel, prfd.	110	+1¼
U. S. Cast Iron Pipe & Fdy.	24	—1
U. S. C. I. P. & Fdy., prfd.	51⅛	+ ⅛
United States Steel	85⅜	— ⅜
United States Steel, prfd.	116½	+ ⅜
Westinghouse Mfg.	68¼	+ ⅜

Resume Dividends

Kokomo, Ind., Dec. 22.—Members of the board of directors of the Kokomo Steel & Wire Co. announced last week, following a meeting, that the company will resume the payment of regular quarterly dividends Jan. 1. The last dividend was paid by the company in March, 1912. Beginning with the first of the year, the customary 1½ per cent quarterly dividend will be paid on the $1,000,000 issue of common stock.

Dividend Ordered

The superior court of Connecticut recently ordered Col. George Pope, receiver of the Pope Mfg. Co., Hartford, Ct., to pay creditors of the company in that jurisdiction an additional dividend of 1⅛ per cent, which will make total dividends of 92⅝ per cent that creditors have been paid. There is a likelihood that still further dividends will be paid creditors. All possible controversy over the final compensation to the receiver and his counsel seems to have been avoided under an agreement that has been entered into, with the consent of all the creditors, that is, that the receiver and his counsel take all the bills receivable. They amount to something in excess of $5,000. The receiver is to lay aside about $14,000 in Connecticut to meet the claim of the National Surety Co., which is contested, and $21,500 has been laid aside for the same purpose in Boston. If the National Surety Co. does not sustain the claim, the money will go to creditors.

Dominion Bridge Profits

The financial statement of the Dominion Bridge Co., of Montreal, for the year ending Oct. 31, showed profits of $1,344,347 after deducting for depreciation, etc. This amounts to 20.7 per cent on the $6,500,000 common stock. After the payment of dividends, transferring $204,282 to reserves, and other deductions, a balance of $382,817 was added to the profit and loss account, which now totals $749,100. The directors reported a marked revival in the demand for structural steel, which it was expected would keep the company's shops busy. The company has opened an office in London to secure foreign business and executed one contract for Madras, India.

Too Much Income

The American Thread Co. is spending a large amount of money in replacing machinery in its plant in Willimantic, Ct., and already many machines have been installed and others will be installed. One reason which prompts the action is that the war income tax in England is so high that the English people who control the company feel it better business policy for them to increase the value of the Connecticut plant and cut down their income, thereby overcoming, in part, the burden of taxation, which is 34½ per cent. A few years ago the company contended that as the money was earned in investments in this country, it was not liable to taxation in England, but Chancellor McKenna ruled that no matter where the money was earned, it was subject to the tax and the owners of the company paid over to England something like $980,000. In the meantime, the British war tax is proving a big benefit to the city of Willimantic.

Slight Decrease

In Exports and Increase in Imports in October

The statistical report of the bureau of foreign and domestic commerce for October shows very heavy exports of iron and steel articles reported on a tonnage basis, although there is some diminution compared with August and September, the tonnage being 405,850 in August, 381,419 in September and 351,039 in October. Exports for the 10 months were more than double those for the similar period in 1914.

	Imports, gross tons.	Exports, gross tons.
January	10,569	139,788
February	7,505	144,363
March	8,025	174,311
April	16,564	223,236
May	28,917	262,306
June	32,201	355,396
July	20,858	378,890
August	27,556	405,850
September	23,345	381,914
October	34,730	351,039

IRON AND STEEL EXPORTS, GROSS TONS.

	October, 1915.	October, 1914.	Ten months ending October, 1915.	Ten months ending October, 1914.
Scrap	17,715	1,012	58,098	30,289
Pig iron	21,212	5,524	178,141	97,538
Billets, ingots and blooms of steel	43,405	6,771	451,306	40,033
Wire rods	13,646	5,716	135,193	47,310
Steel rails	67,783	22,057	292,277	161,830
Steel bars	41,455	9,411	337,611	88,681
Iron bars	3,384	679	29,985	4,380
Struc. iron and steel	23,338	12,234	189,243	160,491
Hoops, band and scroll	3,319	1,105	22,352	7,748
Sh'ts & plates	35,826	23,248	354,522	241,735
Tin and terne plates	16,922	5,950	122,029	50,733
Barbed wire	19,919	15,130	192,803	67,720
All oth. wire	16,782	10,489	184,933	64,109
Cut nails	374	177	3,512	3,227
Wire nails	8,156	5,927	74,769	27,354
All oth. nails includ. tacks	1,041	450	7,220	2,555
Pipes & fit'gs.	10,845	18,143	139,842	169,451
R. R. spikes	2,378	477	7,230	6,426
Bolts, nuts, rivets and washers	2,747	1,502	18,283	13,321
Horseshoes	597	905	14,568	2,953
Cast radiators	195	386	1,845	3,098
Total	351,039	147,293	2,815,762	1,290,982

IRON AND STEEL IMPORTS, GROSS TONS.

	October, 1915.	October, 1914.	Ten months ending October, 1915.	Ten months ending October, 1914.
Scrap	10,517	4,430	40,435	28,923
Pig iron	8,343	11,729	69,234	124,580
Ingots, blooms, billets of steel	946	2,800	10,217	35,556
Wire rods	407	316	4,278	5,957
Rails	13,294	1,299	73,940	19,981
Bar iron	640	1,208	7,235	13,851
Structural	355	40	1,243	8,839
Sheets and plates	116	389	1,040	3,744
Tin & terne plate	112	15	2,235	14,816
Total	34,730	22,226	209,857	256,247

IRON ORE IMPORTS

	October, 1915.	October, 1914.	Ten months ending October, 1915.	Ten months ending October, 1914.
Spain	.....	19,656	32,946	66,982
Sweden	30,579	13,234	185,198	275,753
Canada	23,614	14,631	71,849	48,256
Newfoundland & Labrador	74,160	.....	684,858	38,515
Cuba	9,965	66,820	134,565	698,034
Oth. countries	.....	.....	.....	81,773
Total	138,318	114,341	1,109,416	1,209,313

Favors Uniform Gage.—The National Association of Ornamental Iron and Bronze Manufacturers is endeavoring to secure the adoption of uniform gages for wire and sheet metal, and W. Hume Logan, of the Dow Wire & Iron Works, of Louisville, Ky., representing the organization, has taken the subject up with the bureau of standards at Washington. He has suggested that a bill be drafted for presentation to congress covering the subject. At present a number of gage standards are employed, resulting in a great deal of delay and confusion.

Elect New Members

Announcement is made by the American Iron and Steel Institute of the election of 35 new members to the active and associate classes. As previously announced, only five of those names regularly qualified for the active list could be so elected at this time, on account of the constitutional limit in membership, 1,500, having been reached. Those in the associate list who will be transferred to the active membership as vacancies occur, are indicated. The complete list follows:

Active Members.

William P. Barba, vice president, Midvale Steel Co., Philadelphia.

Julian Burdick, secretary-treasurer and general manager of sales, West Penn Steel Co., Brackenridge, Pa.

Herman M. Hurd, treasurer, Republic Iron & Steel Co., Youngstown, O.

James Claire Miller, secretary-treasurer, Columbus Iron & Steel Co., Columbus, O.

Howell C. Rockhill, vice president, Fort Wayne Rolling Mill Corporation, Fort Wayne, Ind.

Associate Members.

*Louis S. Baldwin, superintendent, the Struthers Furnace Co., Struthers, O.

*William Henry Bennett, superintendent, bar mills, Carnegie Steel Co., Clairton, Pa.

*Duke N. A. Blacet, metallurgical engineer, Central Steel Co., Massillon, O.

*George J. Bryon, master mechanic, Carnegie Steel Co., Duquesne, Pa.

*Morrow Chamberlain, secretary - treasurer, Roane Iron Co., Chattanooga, Tenn.

*Samuel Edwin Eldridge, engineer, Columbus Iron & Steel Co., Columbus, O.

*Herbert L. Hart, manager, bolt and rivet department, Inland Steel Co., Chicago.

Jaquelin S. Holliday, vice president, W. J. Holliday & Co., Indianapolis.

*Horace E. Horton, agronomist, American Steel & Wire Co., Chicago.

*John K. Jones, general manager, Globe Iron Co., Jackson, O.

John M. Keller, chief engineer, National Carbon Co., New York City.

Edward J. Lavino, Philadelphia.

John Edmund McCauley, assistant general manager, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

*Sidney Morrill McCurdy, physician and surgeon, Youngstown Sheet & Tube Co., Youngstown, O.

Edward G. Miner, president, Pfaudler Co., Rochester, N. Y.

*James L. O'Neill, credit manager, Carnegie Steel Co., Pittsburgh.

William Rattle, chemist, Cleveland.

*Walter C. Runyon Jr., assistant to president, Struthers Furnace Co., Cleveland.

*Luciano Selmi, chief chemist, Corrigan McKinney & Co., Cleveland.

Alvan Tracy Simonds, president, Simonds Mfg. Co., Fitchburg, Mass.

Frederick L. Sivyer, president, Northwestern Malleable Iron Co., Milwaukee.

Oberlin Smith, president, Ferracute Machine Co., Bridgeton, N. J.

*William B. Trainer, superintendent, rolling mills, Carnegie Steel Co., Duquesne, Pa.

Alexander T. Whiting, secretary, Whiting Foundry Equipment Co., Harvey, Ill.

*Howard Wood Jr., assistant secretary and assistant treasurer, Alan Wood Iron & Steel Co., Philadelphia.

*Samuel G. Worton, superintendent, open hearth department, Carnegie Steel Co., Duquesne, Pa.

*Stanley Edward Elkin, general manager, Maritime Nail Co., Ltd., St. John N. B.

John Glass, manager, Chicago office, Manufacturers' Record Publishing Co., Chicago.

Frank Gould, vice president, Manufacturers' Record Publishing Co., Baltimore.

*Edward Everett Hughes, general manager, Franklin Steel Works, Franklin, Pa.

*Indicates those placed temporarily on associate list, to be transferred to active list as vacancies occur.

To Build Plant

The Wickwire Steel Co. is about to erect a steel plant and wire mill at Buffalo with a capacity of 400 tons of steel daily. The steel mill will include three 50-ton open hearth furnaces, metal mixer, blooming mill, continuous billet mill and rod mill. The wire mill will be constructed for the manufacture of market wire, including all heavy sizes of finished wire, nails, etc.

The Semet Solvay Co. is to build a battery of 60 by-product ovens on property recently purchased, consisting of 50 acres adjoining the west line of the property of the Wickwire Steel Co. on the River road at Buffalo. The coke manufactured at this plant will be used by the Wickwire Steel Co. in its blast furnaces, but in addition also foundry and domestic coke will be made for the market. The gas produced in the manufacture of this coke will be used by Wickwire Steel Co. in its new plant.

The Wickwire Steel Co. has two modern blast furnaces at Buffalo with combined annual capacity of 250,000 tons of pig iron. The first of the two stacks was blown in Oct. 19, 1908. Previously, Wickwire Bros. had built in 1901 a wire-drawing plant at Cortland, N. Y., to supply wire for their wire cloth works. A steel plant was added to the Cortland works in 1903 with two 30-ton open hearth furnaces and the equipment has been enlarged and improved from time to time. The officers of the Wickwire Steel Co. are: President, T. H. Wickwire; first vice president and treasurer, T. H. Wickwire Jr.; second vice president, H. J. Woodmansee; secretary, W. A. Wickwire.

Shrapnel Contract

Indianapolis, Dec. 22. — Willard A. Bartlett, a broker of Muncie, Ind., announced last week that while on a recent trip to New York he succeeded through eastern agents in closing a contract for 8,000,000 3-inch shrapnel shells for $114,000,000. He said five or six munition plants will engage in the deal, one order for $42,000,000 worth of shells being allotted to firms which he hopes will be induced to work on the contract in Indiana. The contract calls for the first delivery of shells in 90 days.

Munition Orders

The drop forge plant of the Maxim Munitions Corp., New Haven, Ct., has accepted the following orders: 50,000 receivers for model 95 rifles; 50,000 finger levers for model 95 rifles; 1,000,000 appendages for Russian rifles; 50,000 anchor plates. These orders are in addition to the work which the drop forge plant will do in connection with the Maxim automatic machine gun, referred to in previous issues.

New Tin Mills.—The Standard Tin Plate Co., Cannonsburg, Pa., is completing 12 additional hot tin mills, providing a total of 22, which will give the company an annual capacity of about 1,750,000 base boxes of tin plate. The new mills will be electrically driven and it is the intention to drive the old mills by electricity as soon as necessary changes can be made.

Atlanta Steel Co. Sold

The entire property and assets of the Atlanta Steel Co., Atlanta, Ga., have been sold to an eastern syndicate organized under the name of the Atlantic Steel Co. Stockholders of the company, at a recent meeting, voted to transfer the stock, plant and good will of the company to the new corporation at a price which will net par value to the holders of the $750,000 common stock. The company also has turned over $470,000 in bonds and $180,000 in preferred stock. The new company is headed by the banking house of William Morris, Imbrie & Co., New York City.

The Atlantic Steel Co. will operate the plant as before, and plans to increase the output. It will retain the services of the officers and employes of the old concern, as one of the terms of the transfer. These are as follows: President and treasurer, T. K. Glenn; vice president, Charles E. Currier; secretary, Robert Gregg; and directors, Mr. Glenn, Mr. Currier, J. Bulow Campbell, Ernest Woodruff, John N. Goddard, J. Carroll Payne, Thomas Eggleston, Frank Hawkins and J. T. Rose, all of Atlanta, and Edgar Palmer, New York City.

It is stated that the company will have no connection with any other steel manufacturing concern.

Orders New Ship

The Pittsburgh Steamship Co., Cleveland, has given an order to the American Ship Building Co. for another 600-footer, making three steamers of that size now building for it. The shipyards now have under order six steamers of the 600-foot class for 1916 delivery, though all of them cannot be delivered by spring. The new steamer just ordered will not come out until fall. Negotiations are still active for the purchase of additional tonnage by leading shippers and a number of vessels will probably change hands before the first of the year.

New Era Engineering Co., Joliet, Ill., has increased its capital stock from $30,000 to $200,000.

Countless Problems of the Mines

(Sixth of a Series of Short Talks on Iron Mining)

BY P. B. McDONALD, Mining Engineer

Of late years, there have been so many new iron mines developed side by side on the ranges of Michigan and Minnesota, and so many different men have worked at developing them, that the practice of mining as evolved at Lake Superior has become in a way standard. That is, it has and it hasn't. For, although many matters of general practice are similar at the different mines, and much of the daily routine (of shaft sinking, drifting, stoping, pumping, drilling, blasting, hoisting, etc.) seems about the same at one property as at another, there are still such vast differences in the various problems that confront the superintendent, "mining captain", master mechanic and "surface boss", that these officials are kept guessing a good part of the time. Nowhere in the world, it may be safely said, is ore found in such un-get-at-able places as in the Michigan field, and no where is there such a variety of shapes, sizes, structures, textures, and general differences in ore deposits as in the Lake Superior region as a whole.

The ore bodies are found beneath swamps, and lying under quicksand, and next to soft, crumbly slate which caves in on the ore, and behind huge thicknesses of hard quartzite, and under lakes, in flat lenses, in stringers, in masses, in "stove-pipes", vertical seams, veins, sheets, blocks, and sometimes it is not found at all. Thus, though a mine superintendent may be aided and guided by what is going on in the other mines around him, he mostly has to follow his own ore and get it out in the cheapest manner suited to the individual difficulties of that particular ore body. Possibly after planning out a method of mining his ore which promises to give good results, it is found, as the mine gets deeper, that the ore has changed from a hard ore to a soft ore, or from a wide body to a narrow body. So the method of stoping and development has to be entirely changed.

In addition to these larger problems that puzzle and bother a superintendent at an iron mine, there are any number of queer miscellaneous predicaments that accompany the various phases of removing ore from the ground in large quantities and shipping it. I remember how hard a certain superintendent on the Mesabi swore one morning in May, when, after getting a locomotive and a string of cars on a side track to the mine's large stockpile, and after starting the steam-shovel to loading cars, the work was brought to a stand-still by the discovery that, due to the ore having been dumped on the pile in the winter, and being a very wet, soft, sloppy ore, it had frozen tight under the loose exterior of the later dumpings. A half dozen miners were quickly hoisted from the mine and told to "gopher-hole" right to the center of the pile, where kegs and kegs of black powder were then packed for making a grand loosening of the whole dump. The superintendent said he'd "show 'em how to break up a pile of frozen ore!" When the blast was put off, the train was blown from the track, the cars smashed, and great clouds of heavy ore distributed over the place; for the frozen part of the pile was in fact only a crust on the outside, and the bulk of the ore was soft and unfrozen.

The superintendent had "showed 'em" a bit too strong.

English Decree Has Little Effect

Buying Will Be Concentrated in Government's Hands to Eliminate Speculators—

Russian Inquiry Features Market—Pittsburgh Mills Buy Heavily

FURTHER details regarding the English government's decision to limit imports of machine tools into the United Kingdom are being slowly revealed. The trade in the east has received assurances from houses of standing in London, that the proclamation is not intended to ban imports of machine tools, the intention of the government being to protect Great Britain against the activities of speculators and brokers who render no service in return for the large profits they reap. One London house states that it is believed the government commission within whose scope comes the question of machine tools, will designate probably five leading English machine tool concerns, with whom the responsibility over all machine tool imports will be lodged. Consequently, deliveries on all contracts made with properly authorized British representatives will meet with no interference.

The feature of the market, as far as business is concerned, continues to be the heavy buying by Russian representatives, who are taking practically all kinds of tools which are available for delivery within a reasonable time. A large percentage of this business is being placed by the Russian commission, headed by Major General Sapojnikoff, which has headquarters in the Flatiron building, New York. Demand from England, as previously reported, is of comparatively small proportions. French buying also is in smaller volume, although there continues to be a good volume of French inquiry. The Mission Francaise d'Artillerie, with headquarters at 10 Bridge street, room 918, New York, continues in the market for machine tools, motor trucks and shells of all diameters. Fair buying continues to be done by domestic munition makers, but no large transactions, such as featured the market a few months ago, are noted. In fact, outside of the Russian purchases, the market, except for the sold-up condition characterizing nearly all machine tools, wears somewhat the same aspect as it reflects in normally prosperous times. Demand is active, but it consists mostly of orders for one, two or three tools. Some further good buying has come out from the ship building companies and much further business is expected from these interests. It is believed that the Samuel L. Moore & Sons Corporation, Elizabethport, N. J., shortly will be in the market; this concern is about to begin work on one or two of the buildings which will form part of its proposed ship building plant. The Midvale Steel & Ordnance Co. has placed an order for ten 5-ton cranes with the Northern Engineering Co.; these will be installed in a large new machine shop at Nicetown, Philadelphia. The Midvale company is expected shortly to buy a large amount of equipment for improvements and extensions to its plant at Coatesville, Pa. The Philadelphia Steel & Forge Co., Tacony, Philadelphia, has bought one 25-ton Northern crane. The Pennsylvania Steel Co. has placed orders for two 10-ton cranes. The American Smelters Securities Co., New York, is in the market for one 10-ton crane. The Maryland Steel Co. has purchased two 10-ton cranes with magnet attachments. The Pennsylvania railroad has issued inquiries for seven or eight machine tools. The Baltimore & Ohio bought a few tools and has issued a few more inquiries.

Among eastern concerns who are expanding their capacity are the Otis Elevator Co., Harrison, N. J.; Arcade Malleable Iron Co., Worcester, Mass.; Abrasive Material Co., Philadelphia; Foundry, Motor Car & Mfg. Co., a new concern at St. Albans, Vt.; Crucible Steel Co. of America, at both its Syracuse, N. Y., and Harrison, N. J., plants; Keystone Supply & Mfg. Co., Philadelphia; Henry Disston & Sons, Inc., Philadelphia; Potter & Johnson Co., Pawtucket, R. I., which has bought the plant of the Brown Cotton Gin Co., New London, Ct.; Evans Stamping & Plating Co., Taunton, Mass.; Broad Gauge Iron Works, Boston, which will build a new plant at Everett, Mass.; Schneider-Bowman Co., Frankford, Philadelphia; Rochester Motor Co., Rochester, N. Y.; Syracuse Malleable Iron Co., Syracuse, N. Y.; Miller Lock Co., Frankford, Philadelphia; North East Electric Co., Rochester, N. Y.; Saco Lowell Shops, which will build a foundry at Newton Upper Falls, Mass., and the Housel & Blair Machine Co., Williamsport, Pa.

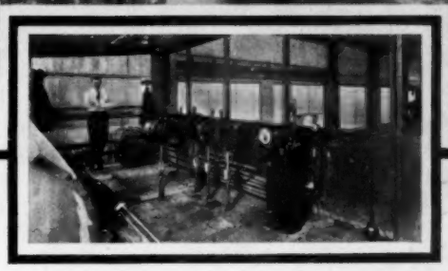
Pittsburgh Market Steady

No diminution in buying of machinery and heavy rolling mill equipment is noted by builders and dealers in the Pittsburgh district. Inquiries are coming out in heavy volume and a large number of orders are being placed. A Pittsburgh fabricating concern has just closed contracts for a number of machine tools, including three radial drills and a large shear. The Aluminum Co. of America has closed for three cranes for installation in its plant at East St. Louis. The Barber Asphalt Co., Mauer, N. J., has ordered a gantry crane from a Cleveland builder. The American Sheet & Tin Plate Co. is reported to have awarded contracts for 11 cranes for its plant at Gary, Ind. The Pittsburgh Lamp, Brass & Glass Co., Pittsburgh, is in the market for a second-hand air compressor.

English Embargo Affects Chicago Dealers

Embargo on machine tool shipments into Great Britain is having some effect on Chicago dealers, a number of machines ready for shipment being ordered held until arrangements can be made for handling them. The freight embargo placed by railroads on goods destined for export through Atlantic ports is another factor to make business rather slower. However, buying on the part of brokers desiring machinery for export is keeping up and inquiry has not lessened. It is believed that the embargo on the part of the English government will not delay shipments of new and first grade machines, but probably will shut out some second-hand tools. The Great Northern railroad has closed for the tools mentioned last week, a portion being taken by Chicago dealers. The Illinois Steel Co. is understood to be compiling a list of tools for use in connection with the building program now under way at Gary and South Chicago. The Inland Steel Co. has bought some material recently and is in need of additional machines for its

Above, Blooming Mill in Operation



To the Left, View of Pulpit

Kneading the Steel like Dough

Just as quality in *bread* depends upon the correct kneading and working of the dough, so quality in STEEL depends upon proper manipulation in the blooming mill.

It is the blooming mill that makes the metal tough, homogeneous, dense and fibrous; therefore the blooming mill should be powerful and thoroughly efficient.

Such a blooming mill has been installed in the plant of The Central Steel Company, and is controlled by highly skilled rollers stationed in a pulpit where they can conveniently supervise every detail of the operation.

Our very large capacity guarantees our producing your order of "Agathon" Steel in record time, and the three railroads at our service insure you prompt delivery.

AGATHON STEELS

WILL SERVE YOUR PURPOSES *BEST!*

WE MAKE

"AGATHON" Chrome Nickel
"AGATHON" Chrome Vanadium
"AGATHON" Nickel Steels
"AGATHON" Special Analyses
"AGATHON" Vanadium
"AGATHON" Silico-Manganese
"AGATHON" Chrome Steel
"AGATHON" High Carbon

THE CENTRAL STEEL COMPANY

MASSILLON, OHIO

Detroit Office: 326-27-28 Ford Bldg.
Cleveland Office: Hickox Bldg.

F. Walter Guibert, District Representative
The Hamill-Hickox Co., District Representative

mills. Domestic demand is on the increase and inquiry comes from all sorts of sources, indicating a general revival of business. Price no longer operates as a bar to buying, delivery being the principal consideration. A decided revival is noted in Minneapolis and tributary territory. Tractor manufacturers and shops with shrapnel contracts are subletting work and this has created a demand for equipment. Deliveries from manufacturers continue slow and buyers find deliveries deferred several weeks. The La Salle Machine & Tool Co., La Salle, Ill., has closed a deal with the Heald Machinery Co., Worcester, Mass., and will take over the manufacturing rights for the latter company's twist drill grinder, including tools, patents, drawings and parts in stock.

Cleveland Market Quiet

The machine tool market at Cleveland has experienced no decided change during the past week. There is a considerable volume of new business pending, but few large contracts have been awarded. A local tool dealer reports that one result of the recent embargo by England on machine tools has been to materially decrease the number of speculators in the tool markets. The strike of machinists in Cincinnati has had and is still having a certain effect upon Cleveland dealers. Deliveries are becoming more and more delayed and there is some anxiety as to the ultimate outcome of the situation. The freight congestion in the eastern territory is serious and the traffic conditions affect the market considerably. It is estimated by one road that it has from 50,000 to 55,000 cars on sidings between Pittsburgh and New Jersey points. This block in traffic is affecting shipments abroad, but it has been observed that freight consigned to individual firms in the east receives prompt attention and reasonable delivery. The local branch of an eastern tool builder reports the outlook very favorable for considerable business during the next ten days, as several good-sized contracts are pending. The bulk of the week's business has been in small lots. For the most part it was bought by domestic users, not being destined for munition-making.

Cincinnati Builders Slowing Up

The majority of the larger machine tool plants in Cincinnati are gradually resuming normal activities after being handicapped by a strike of union machinists. Several shops are now running at about 90 per cent capacity, very few being below 75 per cent. Although employing a full force of men, the shops are not equaling their outputs during the first six months of the year, because of the number of inefficient workmen they have been forced to employ. At present, 34 plants in Cincinnati are affected by the strike. Very few new orders are being taken by Cincinnati machine tool makers, as they are booked to capacity for months ahead. Demand from domestic sources is good, and is chiefly for lathes, milling machines and light bench drills and grinders.

EASTERN STATES

ST. ALBANS, VT.—The Foundry Motor Car & Mfg. Co., Inc., has leased the former building of the St. Albans Foundry & Implement Co., and will carry on a general automobile business, as well as manufacturing and general machine work.

BOSTON.—The Broad Gauge Iron Works, 77 Portland street, has let a contract for a 1-story, 65 x 140-foot factory at Everett, Mass.

CLINTON, MASS.—A contract has been awarded for a 36 x 48-foot building for the Clinton Wire Cloth Co., which will be used as a testing plant.

HOLYOKE, MASS.—A contract has been awarded for a 1-story brick addition, 30 x 100 feet, to the plant of the Crocker & McElwin Mfg. Co., on Cabot street, which will be used as a size department.

MARLBORO, MASS.—The Marlboro Products Co. has been incorporated to make metal specialties; $25,000 capital stock; by Hector E. Moineau, president and treasurer; A. Beauregard and H. E. Sawyer.

MEDFORD, MASS.—Land has been bought at Medford in the interests of the Commonwealth Acid Phosphate Co., a Delaware corporation, which is expected to be changed to a Massachusetts corporation. A plant to cost $250,000, for the reduction of ores, is planned.

NEWTON UPPER FALLS, MASS.—Saco Lowell Shops will build a 1-story and basement, 112 x 144-foot foundry.

TAUNTON, MASS.—The Evans Stamping & Plating Co. has let contract for a 1-story 60 x 150-foot foundry.

TAUNTON, MASS.—The Magee Furnace Co., will remove part of its Chelsea, Mass., plant to Taunton, the first week in February and before the end of 1916 the entire plant will be located at Taunton.

WINCHENDON, MASS. — The Green & Hickey Leather Co.'s tannery on River street and valuable machinery were recently badly damaged by fire entailing a loss of about $50,000.

WORCESTER, MASS.—The Norton Co. is adding to its Greendale plant a 2-story, brick, 46 x 386-foot storehouse and a 2-story, brick, 83 x 144-foot kiln shed. A new machine shop on New Bond street is also in contemplation.

WORCESTER, MASS.—The Linehan-Conover Co., has bought the property of the late James A. Colvin, foundryman, 1 Jackson street, which it will convert into a 5-story manufacturing building, and add a 5-story structure in the rear, moving into them in the spring.

WORCESTER, MASS. — The Continental Asbestos Corporation has taken over the International Asbestos Co., Bangor, Me., with lands and mill in Quebec and proposes to increase its capital stock from $250,000 to $500,000 for the purpose of further consolidation and the operation of all the properties involved.

PROVIDENCE, R. I.—The Vim Sales Co., Inc., has been incorporated to build motor vehicles; $10,000 capital stock; by George P. Cressey, Charles O. Cressey and W. Russell Burns.

PROVIDENCE, R. I. — The Continental Metal Co., has been incorporated to make metal products $50,000 capital stock; by John S. Murdock, John H. Tillinghast and B. M. Penney.

PROVIDENCE, R. I. — The Providence Safety Gas Appliance Co. has been incorporated to make metal novelties and gas fixtures; $10,000 capital stock; by Sigmund Rosen, Harry A. Chippendale and William A. Kimball.

BRIDGEPORT, CT.—The Bullard Machine Tool Co., has completed a 2-story, 28 x 180-foot factory on Railroad avenue, which will be used for assembling lathes.

BRIDGEPORT, CT.—Warner Bros. have leased a warehouse in New Milford, Ct., which will be equipped with machinery for a metal goods department. They have also bought a 3-story factory in Stamford which will be used as a box shop.

CHESTER, CT.—C. J. Bates & Son, whose plant was recently damaged by fire will build a 2-story, 40 x 80-foot concrete factory and a 1-story, 30 x 40-foot boiler house to replace the former factory.

DERBY, CT.—The Maxim Munitions Co. has purchased the plant of the Secor Mfg. Co. here and will use it for making cartridges.

HARTFORD, CT.—The Royal Typewriter Co., is having plans prepared for a 4-story, brick, mill construction factory, 200 x 300 feet and also a 1-story power house, to be built on New Park avenue.

NEW BRITAIN, CT. — Landers, Frary & Clark will build a 2-story brick addition, 30 x 105 feet, for the Humason & Beckley plant on Washington street, for use as a grinding department.

NEW HAVEN, CT.—The Tremper-Shields Co. has been incorporated to conduct a general machine shop; $50,000 capital stock; by Charles W. Tremper, Edward R. Shields and Samuel C. Morehouse.

NEW LONDON, CT.—The plant of the Brown Cotton Gin Co. here has been purchased by the Potter & Johnson Co., Pawtucket, R. I. The latter concern will use it for the completion of war orders.

ORANGE, CT.—The New Haven Machine Co. has been incorporated; $25,000 capital stock; by Charles H. Adams, Waterbury, Ct., and Walter and Rose K. Hodgkinson, Hartford.

ROCKVILLE, CT.—The James J. Regan Mfg. Co. has broken ground for a 2-story, 32 x 48-foot addition to its plant on West street, known as the Saxony mill.

WATERBURY, CT.—Plans are being prepared for a factory on Cherry street for the Waterbury Clock Co.

WATERBURY, CT.—The Turner Construction Co. has been awarded a contract by the Scovill Mfg. Co. for the construction of a 5-story, 70 x 352-foot plant. The building will be erected on East Main street, Waterbury.

WINSTED, CT.—The Remington Arms & Ammunition Co.-Union Metallic Cartridge Co. has taken over the Brown Machine Co. and will use it to make tools.

AMSTERDAM, N. Y.—The plant of A. V. Morris & Son, Fort Johnson, near Amsterdam, was seriously damaged by fire with a

Lake Superior Iron Ores

View of the Dean-Itasca Mine controlled by the Tod-Stambaugh Co., Cleveland

The ore from the Dean-Itasca Mine is non-bessemer, of good, coarse structure.

Contracts for this ore for 1916 season are now being taken.

Let us figure on your requirements.

The Tod-Stambaugh Company
Perry-Payne Building
CLEVELAND, OHIO

Say you saw it in THE IRON TRADE REVIEW

loss of $100,000. The company has been awarded several contracts for knit goods for shipment abroad.

NEW YORK. — The Sharpwell Mfg. Co. has been incorporated; $10,000 capital stock; by Ewing M. Forbes, Robert Good and Alexander R. Boyce, 7 West Ninety-second street.

NEW YORK.—The Actus Carburetor & Mfg. Co. has been incorporated to build engines, machines and manufacture automobile supplies; $80,000 capital stock; by Maurice Golden, Madison G. Hawk and George D. Zahnn, 261 Broadway.

ROCHESTER, N. Y.—The North East Electric Co., 348 Whitney street, will build a 1-story, 168 x 264-foot factory addition.

ROCHESTER, N. Y.—The Rochester Motor Co. has begun work on the erection of a 1-story, 62 x 150-foot factory.

SYRACUSE, N. Y.—The Syracuse Malleable Iron Co. has let the contract for a 1-story, 110 x 150-foot foundry addition.

SYRACUSE, N. Y.—A 75 x 140-foot addition will be erected to the plant of the Crucible Steel Co. Building will be fireproof and will cost about $15,000.

ARDMORE, PA.—Estimates are being taken on the construction of a 1-story machine shop, 25 x 40 feet for J. J. Neff, Ardmore.

BAINBRIDGE, PA.—The Kennedy Refractories Co. has been incorporated; $100,000 capital stock; by H. A. Kennedy, Clearfield, Pa.; R. J. Landis, J. B. Engle, Bainbridge.

NEW BRIGHTON, PA.—The Cumberland Coal & Coke Co. has been incorporated; $10,000 capital stock; by H. G. Heedy, Youngstown, O.; O. J. McCleary, Sharon, Pa.; J. G. MacConnell, New Brighton.

NEW CASTLE, PA.—The Keystone Limestone Co. has been incorporated; $60,000 capital stock; by D. H. Kay, James C. Patterson, Judson C. King, New Castle.

PHILADELPHIA.—The Schneider-Bowman Co., Frankford, has let a contract for a 2-story, 50 x 100-foot foundry.

PHILADELPHIA.—Abrasive Material Co., Bridesburg, is receiving estimates on a 3-story 75 x 233-foot factory addition, to be erected at James & Fraley streets.

PHILADELPHIA.—The Midvale Steel & Ordnance Co. has let a contract for the erection of a 1-story, 60 x 550-foot machine shop addition at its plant at Nicetown.

PHILADELPHIA.—C. P. Berger is preparing plans for a 10-story building, 89 x 150 feet to be erected at 329 South Broad street, for the Pennsylvania Taximeter Co.

PHILADELPHIA.—Henry Disston & Sons, Inc., Tacony, has let contracts for the erection of three additions to its file plant, 50 x 366, 50 x 360 and 13 x 22 feet, respectively.

PHILADELPHIA. — The Belmont Iron Works will erect a 1-story, 92 x 108-foot iron and iron frame building to cost about $10,000, for the Philadelphia Steel & Forge Co., Philadelphia.

PHILADELPHIA.—The William Steel & Son Co., architect, is preparing plans for S. B. & B. W. Fleisher, Inc., for a 5-story, brick and concrete building 400 feet long, to be erected at Twenty-sixth and Reed streets.

PHILADELPHIA.—The Niagara Mfg. Co. has been incorporated; $10,000 capital stock; by G. B. H. Martin, S. C. Seymour, Camden, N. J.; F. R. Housel, Harry A. Jacobs, George Turner Jr., H. R. Hillegas, Philadelphia.

PITTSBURGH.—The Donora Zinc Co. has been incorporated; $10,000 capital stock; by C. L. Miller, E. C. McHugh, J. A. Lager, L. R. Martin, R. T. Rossell, Pittsburgh.

PITTSBURGH.—A permit has been granted the Westinghouse interests to erect a 55 x 300-foot storage house for shells. The building will be on Duquesne way.

PITTSBURGH.—The M. S. Zortman Machinery Co. has been incorporated; $10,000 capital stock; by M. S. Zortman, Stephen Stone, Pittsburgh; Russell J. Esler, Tarentum, Pa.

BOONTON, N. J.—The plant of the German American Foundry Co. was damaged by a $5,000 fire.

BOONTON, N. J.—The foundry of Cunningham Bros. was damaged by fire to the extent of $50,000. John H. and James Cunningham, owners, announce that plant will be rebuilt.

CAMDEN, N. J.—The sulphur department of Mechling Bros. chemical plant, and a portion of the Camden Lime plant were damaged by fire. The loss was $30,000. E. S. Mechling is secretary of the chemical company.

DOVER, N. J.—The International High Speed Steel Co., manufacturer of tool steel, will enlarge its plant with an addition 173 x 300 feet.

EAST MILLSTONE, N. J.—The plant of the Somerset Rubber Co. was damaged by fire to the extent of more than $5,000.

ELIZABETH, N. J. — F. L. Schmidt & Co., manufacturers of machinery, will erect an addition 50 x 85 feet on North avenue, to be of steel and concrete.

ELIZABETH, N. J.—F. H. Kalbfleisch has had plans prepared for two plant additions at Baltic street and Third avenue. One will be 70 x 168 feet and the other 70 x 100 feet, both to cost $14,000. The company manufactures chemicals.

ELIZABETH, N. J.—Plans will be submitted to contractors soon for a machine shop for the S. L. Moore & Sons corporation. The first building to be erected will cost approximately $200,000. Other additions are contemplated which will bring the expenditure up to about $1,500,000. The corporation is controlled by the Bethlehem Steel Co.

HARRISON, N. J.—The Crucible Steel Co. of America has filed plans for another addition to its plant at Harrison. This addition will be 60 x 150 feet, will cost approximately $25,000 and will be used as a melting shop.

HARRISON, N. J.—The Otis Elevator Co. is about to begin work on a 100 x 108-foot extension to its gray iron foundry. The foundry when completed will be 100 x 300 feet.

JERSEY CITY, N. J.—The New Jersey Power & Light Corporation has been incorporated to build submarines, with a capital stock of $2,000,000. The Surburban Boat Corporation, of Bayonne, N. J., has also been incorporated to build submarine boats and firearms. The incorporators are Norman Johnson, Mildred W. Stouper and Joseph Barbato, all of New York.

NEWARK, N. J.—The Gould & Eberhardt Machinery Co. will dispose of its plant on Railroad avenue and erect a new plant near Irvington, N. J. Ulrich Eberhardt, treasurer of the concern, denies the plant has been sold to munition manufacturers.

SUMMIT, N. J.—The public service corporation has purchased a site and will erect an office building.

WOODBRIDGE, N. J.—The Bayard Chemical Co. has been incorporated to manufacture chemicals of all kinds; $25,000 capital; by J. B. Baoiridi, Brooklyn; Paul Gross and Russell J. Eddy, New York.

WOODBRIDGE, N. J.—The New Jersey Glue Co., care of J. S. Wright, 101 Smith street, Perth Amboy, N. J., has let a contract to C. W. Smith, Perth Amboy, for the erection of seven buildings at Woodbridge to be used as glue factories.

CENTRAL STATES

CINCINNATI.—Special machinery will be needed by the Cincinnati Rubber Co., which will build two additions to its plant.

CINCINNATI.—The Mal-Gray Castings Co. has been incorporated to make metal products; $50,000 capital stock; by Thomas P. Greenhow, J. W. Brown, F. M. Whittlinger, W. B. Portlage and H. M. McLean.

CLEVELAND.—The Bicknell Construction Co. has been incorporated to do a general construction business; $5,000 capital stock; by B. E. Robertson, M. C. Byrnes, L. M. Henders, W. D. Turner and Warren Bicknell.

COLUMBUS, O.—The Columbus Banknote Co. has awarded the C. R. Curran Construction Co., 150 South Wheatland avenue, a contract for the erection of a 2-story reinforced concrete factory building to cost about $16,000.

DAYTON, O.—The Dayton Time Lock Co. has been incorporated; $500,000 capital stock; by R. M. Wack, J. C. Kimmel, John C. Nee, Thomas A. Keefer and William S. Pichrel.

EAST LIVERPOOL, O.—The Hellyer Electric Co. has been incorporated; $10,000 capital stock; by C. W. Hellyer, W. A. Weaver, Nettie Hellyer, T. H. Fisher and Alexander Lowe.

LIMA, O.—The Lima Steel Castings Co. has increased its capital stock from $50,000 to $100,000.

MECHANICSBURG, O.—The Mechanicsburg Light & Power Co. has been incorporated; capital stock, $18,000; by T. J. Long, Fritz Long, J. R. Long, C. H. Reed and F. L. Clemans.

SPRINGFIELD, O.—The Miller Improved Gas Engine Co. has increased its capital stock from $60,000 to $150,000.

CLAY, KY.—Walter W. Carter is in the market for a steam power dredge, with a 1-yard dipper.

ELKHORN CITY, KY.—The Superior Coal Co. will purchase equipment for a coal-mining plant.

LOUISVILLE, KY.—The Automatic Package Scales Co. is planning to equip a factory. Address C. A. Edinger, president, Fourteenth and Magazine streets.

LOUISVILLE, KY.—The Louisville Soap Co. will buy engines, generators and motors for its new factory, the building for which will cost $50,000. The company has already purchased its boilers from Babcock & Wilcox.

PINEVILLE, KY.—The White Star Coal Co. will buy a 150-kilowatt motor generator set, a 6-ton electric motor, etc. White L. Moss is general manager.

EAST CHICAGO, IND.—The Locomotive Superheater Co., 151st street and Railroad avenue, is building a 1-story factory 90 x 254 feet, costing $40,000.

EAST CHICAGO, IND.—The Union Iron Products Co. has been incorporated to manufacture contractors supplies; $50,000 capital stock; by C. L. Carter, C. E. Kitchen and S. M. Dague.

EVANSVILLE, IND.—The American Locomotive Headlight Co. will build a plant at Evansville.

INDIANAPOLIS — The Robinson Mining Mfg. Co. has been incorporated to manufacture mining machinery; $10,000 capital stock; by Lige Robinson, Oliver Williamson and E. M. Shorter.

KENTLAND, IND.—The D-M Shock Absorber Co. has been incorporated to manufacture automobile shock absorbers; $10,000 capital stock; by Henry J. Russell, Roland R. Cummings and Daniel W. Markley.

MIDDLEBURY, IND.—The Middlebury Extension Roof Co. has been incorporated to manufacture metal roof materials; $10,000 capital stock; by Charles E. Kauffman, C. J. Stahly and Ben E. Wise.

MUNCIE, IND.—The T. W. Warner Co., manufacturer of automobile parts, is building two additions to cost $100,000.

BELVIDERE, ILL.—The Belvidere Screw & Machine Co. will erect an additional building in connection with its plant.

CHICAGO.—The plant of the Illinois Mal-

leable Iron Co. was damaged by a fire that did between $5,000 and $7,000 damage. The core room was seriously damaged.

CHICAGO.—The Dewey Cement Gun Co. has been incorporated; $25,000 capital stock; by C. L. Dewey, S. M. Hunter and Herbert E. Bradley.

CHICAGO.—Bids will be received until Jan. 3, by James B. Dibelka, state architect, 130 North Fifth avenue, for an armory, one and six stories, 200 x 300 feet, for the first regiment cavalry.

CHICAGO.—The A. M. Castle & Co. are erecting an additional warehouse, 60 x 250 feet, steel construction, to be equipped with traveling cranes and requires considerable additional machinery. The addition is to be complete Jan. 15.

KANKAKEE, ILL.—The Burrill Mfg. Co. is building a factory for the manufacture of cement working implements and farm tools.

MOLINE, ILL.—The Mutual Wheel Co. will build a 4-story factory costing $10,000 at Third avenue and Sixth street.

SPRINGFIELD, ILL.—The Western Mfg. Co. is planning to erect a plant for the manufacture of enameled and aluminum ware.

CRYSTAL FALLS, MICH. — The Judson Mining Co. has increased its capital stock from $500,000 to $750,000.

DETROIT.—The Detroit Twist Drill Co. is building a 3-story addition 62 x 119 feet.

DETROIT.—The American Injector Co. has increased its capital stock from $150,000 to $200,000.

DETROIT.—The Consolidated Car Co. has increased its capital stock from $200,000 to $500,000.

DETROIT. — The fire commissioners have asked a bond issue of $350,000 for installing a pumping station.

DETROIT.—The Roberts Tube Works will build an addition to its plant and foundry costing $75,000. The company's product is brass and copper tubing. Pollmar & Ropes, are the architects.

GRAND HAVEN, MICH.—The Dake Engine Works is about to erect an addition 40 x 110 feet, of brick and steel.

LANSING, MICH.—The Lansing Foundry Co. is putting up an addition 70 x 100 feet for an additional cupola and core room, to cost $10,000.

MUSKEGON HEIGHTS, MICH. — Enterprise Brass Works is building a 2-story factory building, 80 x 150 feet, to cost $15,000.

MUSKEGON, MICH.—Lake Foundry & Machine Co. will build a machine shop at Muskegon and will install a 10-ton crane.

PONTIAC, MICH.—The Columbia Motor Truck & Trailer Co. will build a plant 60 x 200 feet at Pontiac.

PLYMOUTH, MICH.—The Plymouth Motor Castings Co. will rebuild with concrete its plant recently damaged by fire.

SAGINAW, MICH.—The Heavenrich Realty Co. has had plans prepared and will erect a 10-story office building to cost about $300,000. Bids are now being received by the company.

KANSAS CITY, MO.—Harrington, Howard & Ash, engineers, are preparing plans for the Twenty-third street viaduct to cost $200,000. Curtis Hill is the city engineer.

KANSAS CITY, MO.—Bids will be received until Jan. 12, by J. B. Langan, city purchasing agent, for a steam turbine reduction gear centrifugal pump unit of 20,000,000 gallons capacity every 24 hours.

ST. JOSEPH, MO.—The Missouri Iron & Metal Co. will issue $125,000 in bonds for machinery and improvements.

ST. LOUIS, MO.—The Mathes Iron & Metal Co., 3132 North Broadway, will build a 3-story warehouse and foundry.

DES MOINES, IA.—The Central Iron & Wire Works is remodeling a building at East Second and Walnut streets and will remove from its present quarters about Jan. 1. The new building is a 2-story structure.

KNOXVILLE, IA. — Bids will be received until Jan. 18, by J. D. Schlotterbach, county auditor, for bridges and culverts to cost $85,000, including four pony 18-beam spans and 88 box culverts.

WATERLOO, IA.—The Cement Tile Machinery Co. will erect a building 36 x 80 feet for its sheet metal departments.

CLOQUET, MINN.—The Cloquet Electric Co. will increase the capacity of its plant. Levi Connors has been awarded a contract for the improvements.

MINNEAPOLIS.—The Northwestern Elevator Co. has plans in view for the erection of a $1,000,000 manufacturing plant to be built on the site of Northwestern elevator, recently damaged by fire. The plant will be located at what is known as the Minnesota transfer. C. A. Magnuson is president of the Northwestern Elevator Co.

NORTH ST. PAUL, MINN.—The Minnesota Mfg. Association is building a plant to manufacture mechanical conveyors for mills and foundries at a cost of $25,000.

SOUTHERN STATES

CHATTANOOGA, TENN. — The David Hosiery Mills will equip a branch mill with 270 knitting machines. Electric motors will be installed.

CHATTANOOGA, TENN. — The Parker Mfg. Co., which has been operating at Florence, Ala., has removed its office to Chattanooga, and is contemplating the establishment of a foundry. The company makes heating and ventilating equipment.

CHILHOW, TENN.—The Southern Slate Co. will install equipment for manufacturing cement.

ELIZABETHTON, TENN.—The Elizabethton Flooring Co. will install additional drying equipment, as well as new woodworking machines, to double its capacity.

KNOXVILLE, TENN.—The Majestic Gray Marble Co., whose mill was recently damaged by fire will rebuild. It will also buy machinery for quarry operations.

NASHVILLE, TENN.—The Tennessee board of control will purchase ice-making equipment for installation at the Western Hospital for the Insane, at Bolivar, Tenn.

NONCONNAH, TENN.—The Illinois Central railroad will build a plant to be equipped for the construction of steel cars at Nonconnah during 1916. Address the general offices at Chicago.

FORT SMITH, ARK.—The Fort Smith Iron & Steel Mill has been incorporated; $25,000 capital stock; by Thomas B. Latham, McAlester; R. W. Cotton, Cameron, and James W. Arnold, Fort Smith.

FORT WORTH, TEX.—The Texas Rolling Mill Co. will build a 50-foot reversible furnace for reheating rails.

GALVESTON, TEX.—The Galveston Dry Dock & Construction Co., Charles N. Crowell, manager, will build a ship building and repair plant, including a 1,000-ton Crandall marine railway and a floating dock of 10,000 tons lifting capacity.

OKLAHOMA CITY, OKLA.—The Oklahoma Welding & Mfg. Co. has been incorporated; $5,000 capital stock; by George A. Hughes, B. McKenna and George E. Clayton.

WESTERN STATES

COFFEYVILLE, KAS.—Election will be held Dec. 28, on issuing bonds for $20,000. Bids will be received about Jan. 10, by Carl E. Stromquist, superintendent water and light department, for water works equipment, including a 500-horsepower water tube high-pressure boiler, with stoker, 750-kilowatt high-pressure, 2,400-volt, 2-phase, 60-cycle turbo-generator with a condenser.

OMAHA, NEB.—The Drake Williams Mount Co., Twenty-third and Hickory streets, will build a boiler shop, one story, 50 x 175 feet.

BILLINGS, MONT.—County commissioners have rejected all bids for furnishing plans and specifications for a $30,000 water works system to be installed at Broadview. New bids will be called for shortly.

SCOBEY, MONT.—It is the intention of the Scobey Electric Light Co. to enlarge its plant at Scobey.

DENVER, COLO.—The Rourte Mfg. Co. has bought the factory and machine shop of the Hasell Iron Works Co., at Colorado Springs, and will install additional machinery.

LEWISTON, IDA.—The city council granted a 99-year lease to Nez Perce & Eastern railroad for terminal grounds.

NAMPA, IDA.—The Nampa Milling & Elevator Co. has decided to double the capacity of its present plant by erecting an addition and installing new machinery.

POCATELLO, IDA.—The Pocatello Transportation & Interurban railroad has been incorporated for the construction of a street railway in Pocatello in the spring. D. W. Standrod is interested.

CHEHALIS, WASH.—County commissioners have decided to call for plans for a 210-foot steel span over Cowlitz river where Cora ferry is operated. The bridge will have concrete steel tubing or abutments and cost about $20,000.

LEAVENWORTH, WASH.—It is reported by A. Van Epps, Leavenworth, that capital has been enlisted in building a railroad a distance of 25 miles from Leavenworth to the property of the Vaneo Mining Co. The line will be completed by Aug. 1 of next year.

METALINE FALLS, WASH.—The Lead & Zinc Co. will enlarge its milling plant. L. D. Larsen is president.

OLYMPIA, WASH.—The state board of land commissioners has granted the Hugh L. Cooper Co. the right to overflow lands on the Pend Oreille river near Blueslide for power project purposes.

SEATTLE, WASH.—The Perfection Automobile Oiler Co. will build a plant to manufacture its devices. This concern was recently incorporated with $100,000 capital stock.

SEATTLE, WASH.—The A. & G. Mfg. & Scale Co., recently incorporated, will build a plant in Seattle. The capital stock of the company is $250,000.

SEATTLE, WASH.—The proposition for providing for the inclusion of the proposed belt line railroad in the plan of port development has been voted, but the proposition to transfer funds to provide for the construction was defeated.

STEVENSON, WASH.—A contract for the construction of a bridge near section 37 has been awarded to the Coast Bridge Co., Portland, Wash.

LOS ANGELES.—The public service commission has authorized F. L. Roehrig, auditor, to prepare plans and specifications for a central power sub-station to cost $50,000.

CANADA

GREENWOOD, B. C.—The Canadian Copper Co. will spend $2,000,000 in developing property at Greenwood.

MONTREAL, QUE.—The Canadian-American Corporation has been incorporated to work mines and smelt ore; $300,000 capital stock; by Louis A. David, Louis A. E. D. Mailhiot and Segfried H. R. Bush, Montreal.

MONTREAL, QUE.—The Montreal Steel & Foundry Co., Ltd., has been incorporated to manufacture iron, steel, and build and deal in machinery; $150,000 capital stock; by Joseph C. Lamothe, Outremont, Que., Emilien Gadbois and Joseph M. Nantel, Montreal.

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

(Delivery April 1.)

Bessemer, valley	$19.00 to 19.50
Bessemer, Pittsburgh	19.95 to 20.45
Basic, Pittsburgh	18.95 to 19.45
Basic, eastern Pa.	18.00 to 18.25
Basic, Buffalo	20.00
Malleable, Pittsburgh	19.45 to 19.95
Malleable foundry, Chicago	18.00
Malleable foundry, Philadelphia	20.50 to 20.75
Malleable foundry, Buffalo	18.00 to 19.00
No. 1X foundry, Philadelphia	20.50 to 20.75
No. 2 foundry, Pittsburgh	19.45 to 19.95
No. 2 foundry, Cleveland	18.80
No. 2 foundry, Ironton	17.50 to 18.00
No. 2 foundry, Chicago	18.00
No. 2X foundry, Philadelphia	19.75 to 20.50
No. 2X fdy., N. J. tidewater	19.75 to 20.50
No. 2X foundry, Buffalo	17.50 to 18.50
No. 2 plain, Philadelphia	19.25 to 19.75
No. 2 plain, N. J. tidewater	19.25 to 19.75
No. 2 plain, Buffalo	17.00
No. 2 southern, Birmingham	14.50 to 15.00
No. 2 southern, Cincinnati	17.40 to 17.90
No. 2 southern, Chicago	18.00 to 18.50
No. 2 southern, Phila. delivery	18.50 to 19.00
No. 2 southern, Cleveland	18.50 to 19.00
No. 2 south'n, New York docks	18.00 to 18.50
No. 2 southern Boston, docks	17.25 to 17.75
No. 2 south. interior, New Eng.	18.50 to 19.50
No. 2 southern, St. Louis	17.90
Virginia No. 2X furnace	17.00 to 18.00
Virginia 2X, Philadelphia	19.75 to 20.75
Virginia 2X, Jersey City	20.00 to 21.00
Virginia 2X, Boston points	20.25 to 21.25
Gray forge, eastern Pa.	17.50 to 18.00
Gray forge, Pittsburgh	18.45
Gray forge, Birmingham	10.50
Silveries, 8 per cent, Jackson, O.	25.00
Silveries, 8 per cent, Chicago	25.50 to 26.50
Low phos. Standard, Phila.	30.50 to 32.50
Low phos. Lebanon, Pa.	30.00 to 31.00
Low phos., Pittsburgh	30.00 to 31.00
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	19.25 to 22.25
Charcoal, Buffalo	19.00 to 20.00
Charcoal, Birmingham	21.50

IRON ORE

Lake Superior Ores.
(Lower Lake Ports.)

Old range Bessemer, 55 per cent, ton	$4.50
Mesabi Bessemer, 55 per cent, ton	4.20
Old range, non-Bess., 51½ per cent, ton	3.75
Mesabi non-Bess., 51½ per cent, ton	3.55

Eastern Ores.
(Per unit delivered eastern Pennsylvania.)

Pt. Henry fur., 60 per cent, unit.	8.6c to 8.9c
Local N. Y. & N. J. ores, unit.	8.5c to 8.75c
Port Henry lump, at mines, ton.	$4.00

Foreign Ores.
(Per unit Philadelphia.)
(Prices nominal.)

Foreign Bess., 50 to 65 per cent	**8 to 8½**
For'n non-Bess., 50 to 65 per cent	**8 to 8½**

COKE

(At the ovens.)

Connellsville furnace	$3.00 to 3.50
Connellsville fur., contract	2.35 to 2.50
Connellsville foundry	3.75 to 4.00
Connellsville fdy. contract	3.00 to 3.25
Wise county furnace	2.85 to 3.10
Wise county foundry	3.25 to 3.50
Pocahontas furnace	2.75 to 3.00
Pocahontas foundry	3.00 to 3.25
New River, foundry	3.25 to 3.75
New River, furnace	3.00 to 3.25

FERRO ALLOYS AND STEEL MAKING METALS

Ferro mang., delivered (prompt)	100
Ferro mang., Balti., (future)	100 to 108
Spiegeleisen 20 per cent, furnace	28.00
Ferro-silicon, 50 per cent, Pbgh.	83.00 to 85.00
Ferro-silicon, 50 per cent, Phila.	83.00 to 85.00

Bessemer ferro-silicon, 9 per cent to 10 per cent, $27.00; 10 ot 11 per cent, $28.00; 11 to 12 per cent, $29.00; 12 to 13 per cent, $30.00 a ton at the furnace at Ashland, Jackson and New Straitsville, O.

Ferro-chrome, 4 to 6 per cent carbon, 25 cents per pound; 2 per cent carbon, 45 cents per pound, delivered.

Ferro-vanadium, $3.15 per pound of contained alloy, Pittsburgh.

Ferro-carbon titanium, 8 to 12½ cents per pound in carloads.

Nickel. 50 to 55 cents per pound.

Ferro-tungsten, nominal.
Cobalt metal, nominal, Pittsburgh.
Aluminum, 59 to 60 cents per pound, New York.
Ferro-molybdenum, Pittsburgh, nominal.

Freight Rates via Panama Canal

Rates on finished materials, including plates, shapes, bars, wire, nails, etc., to Pacific coast points via Panama canal, per 100 lbs., in carload lots, exclusive of insurance and dockage.

From New York	$0.40
From Pittsburgh	.619
From Youngstown	.619
From Niles	.619
From Wheeling	.619
From Steubenville	.619
From Johnstown	.604
From Coatesville	.545
From Steelton	.555
From Bethlehem	.529
From Cleveland	.65
From Chicago	.765

SEMI-FINISHED MATERIAL

Open hearth billets, Phila.	$36.00 to 40.00
Bessemer billets, Phila.	33.00 to 35.00
Forging billets, Phila.	50.00 to 55.00
Forging billets, Pbgh. (nominal)	55.00
Forging billets, Chgo.	40.00 to 45.00
Wire rods, Pittsburgh (nom.)	40.00
Bess. bill., Youngstown	30.00 to 31.00
Open hearth billets, Youngstown	30.00 to 31.00
Bessemer billets, Pittsburgh	30.00 to 31.00
Open hearth billets, Pittsburgh	30.00 to 31.00
Bess. sheet bars, Youngstown	31.00 to 32.00
Op. h'th sheet bars, Youngstown	31.00 to 32.00
Bess. sheet bars, Pittsburgh	31.00 to 32.00
Op. h'th sh. bars, Pbgh.	31.00 to 32.00
Muck bar, Pittsburgh (nominal)	34.00

RAILS AND TRACK MATERIAL

Stand. Bess., rails, Pbgh. & Chg.	1.25c
Stand. op-h'th rails, Pbg. & Chg.	1.34c
Light rails, 8 to 10 lbs., Pbgh.	1.70c
Light rails, 8 lb. Chgo.	1.58c
Light rails, 12 to 14 lbs., Pbgh.	1.65c
Light rails, 12 lbs., Chgo.	1.53c

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—

Cleveland	$0.95
Newark, N. J.	2.98
Boston	3.18
Philadelphia	2.78
Pittsburgh	.95
St. Louis	3.18

Buffalo to:—

Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York and Brookyln (by canal)	1.25 to 1.60

Virginia furnaces to:—

Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88

Birmingham, Ala., to:—

Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky	2.65
New York (all rail)	6.15
New York (rail and water)	4.25
Philadelphia (all rail)	5.20
Philadelphia (rail and water)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75

Chicago to:—

Des Moines	$2.80
Milwaukee	.50
Moline, Ill	1.40
Omaha	3.58
St. Louis	1.58

Ironton and Jackson, O., to:—

Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

Light rails 16 to 20 lbs., Pbgh.	1.60c
Light rails 16 to 20 lbs., Chgo.	1.48c
Light rails 25 to 45 lbs., Pbgh.	1.55c
Light rails 25 to 45 lbs., Chgo.	1.43c
Relaying rails, standard, Pbgh. & Chgo.	$23.00 to 24.00
Relaying rails, light, Chgo.	21.50 to 22.50
Angle bars, st. sect., Pbgh. base.	1.50c to 1.75c
Angle bars, st. sections, Chicago	1.50c to 1.75c
Spikes, railroad, Pbgh.	2.10c
Spikes, railroad, Chgo.	2.10c
Track bolts, Pbgh.	2.50c
Track bolts, Chgo.	2.50c to 2.60c
Tie plates, Chgo.	36.00

SHAPES, PLATES AND BARS

Structural shapes, Pbgh.	1.80c to 2.00c
Structural shapes, Chgo.	1.99c to 2.19c
Structural shapes, Philadelphia.	1.959c to 2.159c
Structural shapes, New York.	1.969c to 2.169c
Struc. shapes, San Francisco.	2.00c to 2.05c
Tank plates, Chgo.	1.99c to 2.19c
Tank plates, Pittsburgh.	1.80c to 2.00c
Tank plates, Philadelphia.	1.959c to 2.409c
Tank plates, New York.	1.969c to 2.419c
Bars, soft steel, Pittsburgh.	1.80c to 2.00c
Bars, soft steel, Chgo.	1.99c to 2.19c
Bars, soft steel, Philadelphia.	1.959c
Bars, soft steel, New York.	1.969c
Hoops, carloads, Pittsburgh.	2.00c
Bands, Pittsburgh	1.80c
Shafting, Pbgh., contr. carloads	45 to 50 off
Bar iron, Chgo.	1.75c
Bar ron, Philadelphia	2.059c
Bar iron, New York	2.069c
Bar iron, Cleveland	1.80c
Bar iron, Pittsburgh	1.90c
Hard steel bars, Chicago	1.80c

SHEETS AND TIN PLATE

No. 28, black, Pittsburgh	2.60c to 2.75c
No. 28, black, Chgo.	2.69c to 2.94c
No. 28, tin mill, black, Pbgh.	2.50c
No. 28, galvanized, Pbgh.	4.75c to 5.25c
No. 28, galvanized, Chgo.	5.19c
No. 10, blue anl'd, Pbgh.	2.25c
No. 10, blue anl'd, Phila.	2.559c to 2.569c
Tin plate, 100 lb., coke base.	$3.60

EXTRAS FOR SHEET OR TIN MILL SPECIFICATIONS

(Per hundred pounds.)

Single picked, cold roll. and re-anld.	30 cents
Hot roll'd pick'd and anl., tin mill.	25 cents
Full pickled, cold rolled and re-anld.	50 cents
Auto sheets	75 cents
Blued stove pipe stock	10 cents
Range steel	30 cents
Re-squaring	10 cents
Roller leveling	10 cents
Patent leveling and re-squaring	35 cents
Oiling sheets	10 cents
Deoxiding	10 cents
Lime finish	10 cents
Open-hearth stamping steel, free fr. mill scale	55 cents
Special open hearth deep stpg. steel free from mill scale	80 cents
Extra deep special auto body stock.	$1.25
Ext. for 28 gage ov. 32 to 36-in. wide	10 cents

No reduction for sheets not annealed.

The above extras apply on both sheet and tin mill specifications, at the same rate.

IRON AND STEEL PIPE

(Pittsburgh.)

	Black. Butt-weld.	Galv. Butt-weld.
Steel, ⅜ to 3 inches	78	63½
Iron, ⅜ to 2½ inches	70	52
	Lap-weld.	
Steel, 2½ to 6 inches	77	62½

BOILER TUBES

Steel, 3½ to 4½ inches l. c. l.	68
Iron, 3½ to 4½ inches l. c. l.	56

WIRE PRODUCTS

(Retailers' price 5 cents above jobbers' quotation.)

Wire nails, jobbers, Pittsburgh	$2.00
Plain wire, jobbers, Pittsburgh	1.85
Galvanized wire, jobbers, Pbgh.	2.55
Polished staples, Pbgh.	2.15
Galvanized staples, Pbgh.	2.85
Barb wire, painted, jobbers, Pbgh.	2.15
Barb wire, galv., jobbers, Pbgh.	2.85